

THE CLUPEOID FISHES
DESCRIBED BY
LACEPÈDE,
CUVIER & VALENCIENNES

P. J. P. WHITEHEAD

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ZOOLOGY

Supplement 2

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CONTENTS

	<i>Page</i>
1. INTRODUCTION	3
2. THE CLUPEOID TYPES IN PARIS	4
3. LACEPÈDE'S CLUPEOID FISHES	5
4. CUVIER'S CLUPEOID FISHES	7
5. VALENCIENNES' CLUPEOID FISHES	9
6. NOTES ON MEASUREMENTS	11
7. NOMENCLATURE	11
8. DESCRIPTIONS OF SPECIES	13
REFERENCES	165
INDEX	171

1. INTRODUCTION

THE clupeoid fishes exceed members of any other group in their importance to world fisheries, as much in temperate as in tropical waters. But faulty identification of material, and indeed a widespread reluctance to attempt more than the sporadic description of new species, has placed serious limitations on biological studies of all but a few well-known forms. In large measure, the systematics of the group is still heavily burdened by poor original descriptions. To alleviate this, the types of the 73 elopoid and clupeoid fishes described by Pieter Bleeker (1849-1872) were examined and re-described (Whitehead, Boeseman & Wheeler, 1966). Similarly, the 22 Chinese elopoids and clupeoids listed by Richardson (1846) have also been studied (Whitehead, 1966a).

Of equal importance, and pre-dating all of Bleeker's names, are the 9 clupeoid species described by Lacepède (1803), the 74 clupeoid species described by Valenciennes (1847, 1848), and the 13 species described by Cuvier (1829). These are re-examined here on the basis of descriptions and, where extant, type material. In addition, all the 207 clupeoid species mentioned by these three authors are identified in the light of more recent studies (Tables 1-3).

The results have thrown considerable light on a number of nomenclatural problems which have long been a source of irritation and confusion, especially within the genus *Sardinella*. The present work is not, in the strict sense, a revision, but examination of the types has enabled certain taxonomic advances to be made. Its primary purpose, however, has been to "fix" the types, mainly through designation and full description of a lectotype. In certain cases, particularly the Lacepède and Cuvier species, stability could be bolstered by later designation of a neotype based on a full revisional study; a suitable specimen has been suggested and is described as a putative neotype.

This work was carried out at the Museum National d'Histoire Naturelle in Paris. I would like to thank Dr. J. Guibé for providing facilities for study of the Paris specimens, and Dr. M. Blanc for his help in searching for the material. I am most grateful to Mlle. Madier and M. Yves Laissus, of the Bibliothèque Centrale, Paris, for photographic negatives of certain Commerson and Plumier drawings.

2. THE CLUPEOID TYPES IN PARIS

The specimens of clupeoid fishes labelled as types in Paris are for the most part those listed by Valenciennes. In addition, there are a number of Bleeker specimens purporting to be types but in fact not deriving from Bleeker's own personal collection; these are non-typical, being from one of the duplicate series sent by Bleeker to a number of European museums (Whitehead, *et alii*, 1966). There are also types of species described by Duméril, Castelnau, Sauvage as well as more modern authors. Cuvier did not mention any actual specimens (but see p. 104), but certain of the Valenciennes specimens were in the collection at that time and could have been examined by him (registration dates given by Bertin, 1940).

A list of the Paris types of isospondylus fishes (Clupeiformes) was given by Bertin (1940), but the identifications are sometimes misleading, certain types are not included, and type status is accorded to a number of specimens which are known now to be non-typical. Bertin's list is useful in showing that certain types which are now missing were apparently absent from the shelves twenty years ago. These are here presumed to be lost.

A few of the Paris types are dry specimens, but the majority are in spirit. Some are in excellent condition, a few appear to have dried out at some time in the past, but most are adequately preserved so that accurate counts and measurements could be made. Unlike the Bleeker types, no consistent cuts, tears, or other damage could be found which would indicate special examination by Valenciennes. The latter's meristic counts were often inaccurate, and his total length measurements were merely approximate, so that it is usually impossible now to determine which (if any) single specimen formed the basis of his description. In selecting a lectotype, I have therefore picked the largest and best preserved specimen in most cases; almost invariably this is the specimen which is already marked with an attached paper tag bearing the registration number. The type status of the remaining specimens is not easy to determine. Bertin (1940) assumed all specimens listed by Valenciennes to be types of one kind or another (paratypes, paratopotypes, etc.).

In some cases some or all the specimens entered into the description, at least in part ; in other cases they certainly did not (e.g. two of the "types" of *Alausa argyrochloris*, which are not *Hilsa* but *Sardinella*). In the vast majority of cases, however, there is absolutely no evidence either way. In some respects this parallels the difficulty encountered in selecting lectotypes from the Bleeker collection (Whitehead, *et alii*, 1966), where it was often uncertain whether a particular fish had actually been part of the syntypical series. For that particular situation, where syntypes and subsequent material were later combined in the same container, proposals have been made to the International Commission to modify either the neotype concept (Whitehead, 1966c) or the lectotype concept (Boeseman, 1966).

In the present case, I have decided to regard *all* Valenciennes material actually mentioned by him as having type status, on the assumption that his descriptions were written with this material in mind. In part, this decision reflects and endorses the curatorial policy of the Paris Museum, and in part it is a recognition that strict modern principles cannot always be applied satisfactorily to authors and collections of a century ago.

3. LACEPÈDE'S CLUPEOID FISHES

Buffon's *Histoire Naturelle*, which was to have covered every aspect of natural history, was incomplete at the time of Buffon's death in 1788. Amongst the subjects remaining were, *inter alii*, the fishes, and this section was completed by Lacepède. Bernard Germain Etienne de la Ville-sur-Ilлон, Comte de Lacepède* (1756-1825), musically as well as scientifically gifted, was highly thought of by Buffon and was subsequently recognized as the latter's worthy successor by his own contemporaries ; he was elected to the chair of fishes and reptiles at the Museum d'Histoire Naturelle in 1795. Although inclined toward the grand literary style of Buffon, Lacepède's contributions to the *Histoire Naturelle* (Vols. 39-44 of the original edition) were a great advance in that the animals were classified into subclasses, divisions, orders and genera† and were not merely described one after the other ; in the quadrupeds, for example, Buffon dealt first with all domestic and then with all wild members (quibbling that *Canis familiaris* was listed by Linnaeus under FERAE!).

Lacepède's major work, the *Histoire Naturelle des Poissons*, appeared in five volumes from 1798 to 1803. Influenced by Daubenton, Lacepède adopted the Linnaean system, although the generic names in Vol. 1 and Vol. 2 (to p. 160) are nearly all in French vernacular only (placed in scientific form by his successor Duméril, 1806 ; no clupeoid names affected). Altogether, Lacepède mentioned 1463 species, or about 1300 when synonyms are discounted, an enormous increase on Linnaeus (about 300) and Gmelin (about 800). Following Willughby and Pennant, Lacepède classified the fishes into two subclasses, cartilaginous and bony, a division which he then confused by placing *Les Balistes* in the former, side by side with *Les Lophies* and *Les Chimeres* (Lacepède, 1798, Table 1). He proposed four Divisions

* For the accentuation of this name, I have followed Sherborn (1902, p. lvii), who states "Lacepède, in a letter dated 1831 signed "b.g.é. i cte de lacepède" . . ." Most French authors disagree and use Lacépède.

† Contrast Buffon's statement "il n'existe réellement dans la Nature que les individus ; les genres, les ordres, et les classes n'existent que dans notre imagination."

in each subclass, and each Division contained four possibilities (Apodes, Jugulares, Thoracins and Abdominaux), a system that led, for example, to a fragmentation of the eels, and the juxtaposition of the clupeid *Odontognathus* with *Regalecus* and *Muraena*.

The remainder of Lacepède's classification was equally unsuccessful (in modern eyes). The clupeoid fishes do not appear as a distinct group, and not only are they mixed with the elopoids, but they are interspersed between quite unrelated genera; *Odontognathus* even appears three volumes before the remaining four Lacepède clupeoid genera. It was only with the enormous increase in the size of the Paris collections in the time of Valenciennes that the extent of the clupeoids as a group could be fully appreciated, particularly since the vast majority of species are tropical and subtropical.

Lacepède mentioned 27 apparent clupeoid species (Table 1). Two of these, *Clupea fasciata* and *Clupea tropica*, are not clupeoids, and three belong to related groups,

Clupea dorab = *Chirocentrus dorab*

Clupea cyprinoides = *Megalops cyprinoides*

Clupea macrocephala = *Albula vulpes*

Of the remainder, nine were new species, three of them here accepted as senior synonyms. He placed his clupeoids in five genera, *Clupea*, *Clupanodon*, *Odontognathus*, *Stolephorus* and *Mystus*, all but the first being new, and all but the last still accepted (*Mystus* was pre-occupied). While the inclusion of species of *Chirocentrus*, *Megalops* and *Albula* amongst his "clupeoids" is understandable, the appearance of such species elsewhere and in such varied genera (e.g. *Synodus*, *Esox*, *Butyrinus*, *Argentina*, *Megalops*) shows how loose his concept of these genera was. Like earlier authors, Lacepède still retained the genus *Clupea* as a compendium genus, perhaps wittingly so, since it is much the largest of his five and contains clupeids, engraulids, an elopid, an albulid and a chirocentrid.

Four of the figures given by Lacepède refer to "clupeoid" fishes. They were the work of Jacques de Sève, who was responsible for almost all the 1290 plates illustrating the 44 volumes of *Histoire Naturelle*. The clupeoid figures are generally poor, which is surprising because de Sève's draughtsmanship is evident in the plates of other groups as well as in his sketches (e.g. Plate 13 in Heim, 1952). In the clupeoid figures, scales are shown quite arbitrarily, while details of jaws and bones of the opercular series are omitted; as a result, one is inclined to mistrust finray counts and even fin positions. The standard of a zoological illustration normally depends on the significance attached to the parts of the subject; details of the head and scale counts played little part in Lacepède's descriptions of clupeoid fishes.

Many of Lacepède's species were based on drawings and/or descriptions with polynomial manuscript names by the naturalist-explorer Philibert Commerson.* Three of Commerson's drawings are reproduced here (Plate 3a, c and Plate 9c), each of which was copied (but reversed) by de Sève for the corresponding Lacepède

* Commerson lived on Mauritius from 1768 to 1773, visiting some of the surrounding islands and collecting specimens. Cuvier (1828: 122) gave notes on Commerson's work, and an example of the thoroughness of Commerson's descriptions is cited by Boeseman (1960, pls. VII and VIII).

figures. Unfortunately, the notes which may have accompanied the drawings are no longer extant.

Six Lacepède clupeoid species seem to have been based solely on Commerson drawings and notes, with no mention of specimens,

<i>Stolephorus commersonii</i>	<i>Clupea chrysoptera</i>
<i>Clupea vittargentea</i>	<i>Clupea fasciata</i>
<i>Clupea tuberculosa</i>	<i>Clupanodon jussieu</i>

Lacepède cited the Commerson polynomials in his synonymies, and in some cases the first element of Commerson's polynomial has been claimed to be an eligible generic name, e.g.

Encrasicholus mandibula inferiore etc. (*C. vittargentea*)

Halex corpore catheteplates etc. (*C. fasciata*)

Jordan (1917) listed 17 such cases of Commerson "genera" published in Lacepède's synonymies, pointing out that two were accepted by the International Commission (*Antennarius* and *Aspro*, Opinions 23 and 24). *Halex* is not a clupeoid genus, but *Encrasicholus* may be a junior synonym of *Stolephorus* (see p. 136). There is, however, no virtue in its acceptance, quite apart from the illegality of Commerson generic names (suppressed by Opinion 89).

Similarly, Lacepède based a number of his species on drawings and polynomially named manuscript descriptions of fishes sent by Le Père Plumier (1646-1705), a missionary in Martinique. Jordan (1917) listed 18 "generic" names derived in the same way as those attributed to Commerson. One of these is involved in the present study, *Trichis* (see p. 77), but here again it is of no value to the nomenclature (no ruling yet by the Commission). One Plumier drawing is shown here (Plate 5c).

At the present time, only two clupeoid specimens exist which may have been examined by Lacepède (*Clupea fallax* and *Odontognathus mucronatus*). Apart from these, the remaining clupeoids, according to the dates of acquisition by the Museum given by Bertin (1940), date from the second decade of the 19th century, the earliest being from Leschenault's collections (1818).

A good general account of the life and work of Lacepède has been given by Bertin (1945).

4. CUVIER'S CLUPEOID SPECIES

George Léopold Chrétien Frédéric Dagobert Cuvier (1769-1832), later Baron Cuvier, enters the present study in a slightly different role to that of Lacepède and Valenciennes. His only published work dealing with new species and genera of clupeoid fishes is the *Règne Animal*, a comprehensive survey of the broad outlines of the animal kingdom. Species are only included as examples of genera, and the vast majority are cited merely as footnotes without description. Cuvier did, however, give a latin name to many species previously described or figured under a vernacular name (especially those of Russell) and such Cuvier names are valid, being "a bibliographic reference to a previously published description, definition or figure" (Art. 16 (a), International Code, 1961).

While professor at the central school of the Panthéon in Paris, Cuvier (1797) published his *Tableau elementaire de l'Histoire naturelle des Animaux*. This work listed four clupeoid species (*Clupea harengus*, *C. sprattus*, *C. alosa* and *C. encrasicolus*), and no new names were involved.

In the first edition of the *Règne Animal*, Cuvier listed 15 clupeoid species, none of which were new; most are Linnaeus and Bloch species. He introduced three new genera, *Engraulis*, *Thrissa* and *Pristigaster*.

In the second edition of the *Règne Animal*, Cuvier increased his list of clupeoid species to 44 (7 still as vernacular names), but he omitted three Bloch names of the previous edition (*Clupea sinensis*, *C. africana* and *C. malabarica*) for reasons not stated. Cuvier proposed 13 new clupeoid species names, and one new generic name (*Chatoessus*). A full list of the species mentioned by Cuvier is given in Table 2.

The first edition of the *Règne Animal* marks a new era in zoological classification and in the section on fishes the hand of a great anatomist is no less apparent. For the first time, the clupeoid fishes are not only released from a single genus *Clupea* (Lacepède had already attempted this) but they are placed altogether in a single family, *Les Clupes*, albeit still combined with elopoids, osteoglossoids, etc. *Les Clupes* is the fifth of Cuvier's five families of Abdominal Malacopterygians. Six of its sixteen groups are of interest here.

1. Les Harengs (11 species, mainly Clupeinae)
2. Les Aloses (10 species, Alosinae + some Dorosomatinae)
3. Les Cailleu-Tassarts (6 species, Alosinae + Dorosomatinae + Clupeinae)
4. Les Odontognathes (1 species, Pristigasterinae)
5. Les Pristigastres (2 species, Pristigasterinae)
6. Les Anchois (14 species, Engraulidae).

It is noticeable that the anchovies are for the first time given as a distinct group, as also *Chirocentrus*, *Megalops*, *Elops* and *Albula* (*Les Chirocentres*, *Les Megalops*, *Les Elopes* and *Les Butirins*). The six groups listed above bear a great similarity to the modern clupeoid subfamilies, and it can be noted in regard to groups 2 and 3 that Regan (1917b) was quite against a separation of the Alosinae and the Dorosomatinae.

Cuvier may be presumed to have examined specimens, but there is indirect evidence in only two cases that any of the specimens surviving today formed the basis of his species or genera (e.g. *Odontognathus mucronatus* and *Pristigaster cayanus*). Many of Cuvier's names are, however, valid senior synonyms, and in the interests of stability they should be provided with neotypes. Suitable specimens are described here for future designation.

The dating of the 1st edition of the *Règne Animal* presents certain difficulties. Mathews (1911) stated "From the Bibliotheque Français I gained the following dates of receipt: Le Règne Animal, 4 vols. in octavo, each 130 sheets plus 15 pls., Dec. 7, 1816." Ten years later, Sherborn pasted a note in one of the copies of the *Règne Animal* in the Zoological Library of this museum stating that he was not satisfied with the earlier date and preferred to cite the work as 1817. In the *Index Animalium*, Sherborn (1922: xli) stated that the first volume "was issued in Dec. 1816", but not the remaining volumes. Sherborn probably argued this dating with

Mathews, but the latter (Mathews, 1925) still held to the earlier date for all four volumes, i.e. "before Dec. 7th, 1816", and he quoted Cuvier himself as saying (source uncited) "... my first volume was printed in the beginning of 1816" (but the preface to the first volume bears the date October, 1816). *La Bibliographie de la France* (No. 49 of Saturday, 17th December 1816, No. 3463, p. 536) gave 1816 for all four volumes and there is no mention of the work in the volume for 1817, Quérard, in *La France Littéraire* . . . (1828, 2 : 365) also gave 1816 for all four volumes. Because of Sherborn's doubts, and the apparent impossibility of establishing a firm date, I have preferred here to continue to cite the *Règne Animal* first edition as 1817 (as on the title page of volume 1). The main problem that this raises concerns the apparent prior use of certain Cuvier names by Bosc and others in the various dictionaries that were appearing at that time (see for example under *Engraulis*, p. 124). Thus, the first three volumes of the *Nouveau Dictionnaire* (to which Bosc contributed) were dated September 14th, 1816 by Mathews (1911), the remaining volumes dating from December 14th or later. The view taken here is that the International Commission should validate all Cuvier names regardless of their predating by Bosc or others, the latter being purely accidental (Whitehead, 1967b).

Mathews (1925) dated volumes 1, 2, 4 and 5 of the 2nd edition of the *Règne Animal* as "before April 11th, 1829", but volume 3 did not appear until March 27th, 1830.

Cuvier listed many names in the vernacular. Oken, in the 1817 volume of *Isis*, supplied Latin equivalents and these were listed by Gill (1903). There are no clupeoid names affected.

A useful contemporary account of the life and work of Cuvier is that given by Lee (1833). As Mrs Bowdich, she and her first husband had stayed for six months with the Cuvier's.

5. VALENCIENNES' CLUPEOID FISHES

Monod (1963) has given a compact account of what is known of Valenciennes' career at the Museum d'Histoire Naturelle and some useful notes on the authorship and publication of the 22 volumes of the *Histoire Naturelle des Poissons*. He emphasized the fact that Valenciennes himself wrote two-thirds of this work (7259 pages, against 3501 by Cuvier), and agreed with the contention that separate authorship should be accorded respectively to Cuvier and Valenciennes for the parts they actually wrote. As a result of an application by Bailey (1957), the International Commission (Opinion 580) ruled in favour of separate authorship according to the scheme worked out earlier by Bailey (1951).

Although there have been opponents to the separate authorship ruling (Tucker, 1962 ; Myers, 1960), the justification for it is certainly apparent in those volumes (such as 20 and 21 which include the clupeoids) which were published after Cuvier's death. For there are occasions when a Cuvier name (from the 2nd edition of the *Règne Animal*) is used again in the *Histoire Naturelle des Poissons*, but in quite a

different sense and without reference to the Cuvier species (e.g. *Harengula latulus* Val. and *Clupea latulus* Cuv.—see discussion, p. 23). There are specimens which were certainly available to Cuvier even before publication of the 2nd edition of the *Règne Animal* (1829). Had Cuvier examined and labelled these, there could have been no disagreement when Valenciennes re-described them. It is true that, at least as far as the clupeoid species are concerned, Cuvier did not indicate types and often proposed names for fishes until then known only by vernacular name or by a drawing. But this study of the clupeoid fishes strongly suggests that Valenciennes approached the group anew and without the aid of collaboration with Cuvier before the latter's death. In fact, Valenciennes (1847a) infers that he had made no very deep study of the clupeoids up to 1837. There are, indeed, occasions when Valenciennes frankly disagreed with Cuvier's treatment of a species and, with respect to his "maitre", said so (e.g. over Cuvier's *Clupea melanura*). To continue to accord joint authorship to this is illogical.

Valenciennes wrote at a time when a large amount of material was being deposited in Paris, and for the first time the much richer Indo-Pacific fauna begins to overshadow the poorer but better known European fauna in a work devoted to both. The number of clupeoid species is enormously increased. Valenciennes recognized 138 species, of which he described 74 as new (Table 3). The fact that most of the type specimens are still extant increases the importance of the Valenciennes names, although one could wish that the types had afterwards been examined more frequently and critically, in the case of the clupeoids at least.

One of the most far-reaching but unfortunate contributions made by Valenciennes in his review of clupeoid species was his system of genera. Valenciennes proposed 11 new clupeoid genera, and since five of these are still recognized (plus *Clupeonia* as a subgenus), it would seem at first sight that the systematics of the clupeoids had been considerably advanced. This, however, was only partly true. Valenciennes based his system almost entirely on the presence or absence of teeth in the jaws and in the mouth, equating each new permutation with a new genus. Subsequent work has shown the instability of this character. The result was a wide separation of closely related or even the same species, as is apparent in Tables 3 and 4, and this is especially the case where juvenile fishes were concerned.

Bleeker seems to have followed Valenciennes' system initially, but by the time that he began revising the clupeoid fishes for the Atlas (about 1868, see Whitehead, *et alii*, 1966) he had evolved his own much better system. Gill (1861), in a review of the clupeoid fishes, frankly endorsed the Valenciennes system, stating that the genera were "almost entirely characterized by the different combinations, of teeth on the jaws and in the mouth . . .". Günther (1868) barely concealed his irritation at the Valenciennes system and took the opposite road, arriving at no less than 60 species in his genus *Clupea*. It was not until the classic revisions of the Clupeidae by Regan (1916, 1917a, b, 1922) that many of Valenciennes' genera were justified, although on grounds other than dentition.

6. NOTES ON MEASUREMENTS

The following abbreviations have been used in the descriptions.

Br.St.	branchiostegal rays	g.r.	gillrakers of 1st arch, usually of lower part, but with plus sign when upper rakers included
D	dorsal count		
P	pectoral count	scutes	ventral scutes
V	pelvic count	scales	number in lateral series
A	anal count	tot.l.	total length
S.L.	standard length	(indet.)	too damaged for count
(n.r.)	not recorded		
MNH.	Museum National d'Histoire Naturelle, Paris.		
BMNH.	British Museum (Natural History), London.		
RMNH.	Rijksmuseum van Natuurlijke Historie, Leiden.		

The following measurements can be defined.

- S.L. snout tip to base of caudal rays.
- tot.l. tip of snout (or lower jaw) to tip of depressed upper caudal lobe.
- head length: longest measurement from tip of snout.

7. NOMENCLATURE

A number of early and generally overlooked works have been examined during this study, resulting in the discovery of no less than ten *nomina oblita*. Notwithstanding the well-deserved ridicule that Smith (1964) has poured on the present formulation of the Statute of Limitation, no purpose would be served by resurrecting any of these ten names, and application will be made to suppress them. The names involved are :

- Clupea allecia* Rafinesque, 1810 = *Sardinella aurita* Valenciennes, 1847
- Alosa senegalensis* Bennett, 1831 = *S. aurita* Valenciennes, 1847
- Clupea aurovittata* Swainson, 1838 = *S. aurita* Valenciennes, 1847
- Clupea caeruleovittata* Richardson, 1846* = *S. aurita* Valenciennes, 1847
- Meletta suoerii* Valenciennes, 1847 = *Alosa alabamiae* J. & E., 1896
- Pristigaster triangularis* Stark, 1828 = *Pristigaster cayana* Cuvier, 1829
- Platygaster macrophthalma* Swainson, 1838 = *Ilisha megaloptera* Swainson, 1839
- Platygaster verticalis* Swainson, 1838 = *Ilisha indica* Swainson, 1839
- Clupea melastoma* Bloch & Schneider, 1801 = *Pellona ditchela* Valenciennes, 1847
- Chirocentrus russellii* Swainson, 1838 = *Chirocentrus nudus* Swainson, 1839.

The following four names are *nomina nuda* and application will be made to suppress them :

- Elops javanicus* Valenciennes, 1847
- Clupea otaitensis* Valenciennes, 1847
- Megalops bimaculata* Valenciennes, 1848
- Engraulis louisiana* Valenciennes, 1848.

The status of Cuvier's *Pristigaster* and *Pristigaster cayana* are discussed (p. 101). It is concluded that both should be considered valid notwithstanding Cuvier's omission of a species name when first describing the genus, and use of a vernacular name for his figure of the species. Application will be made to place this binomen on the Official List.

* Application to suppress this name already made, *Bull. zool. Nomencl.*, **23** (1) : 62-64.

The following ten names are considered here to have doubtful status :

Atherina japonica Houttuyn, 1782*
Clupanodon jussieu Lacepède, 1803
Engraulis desmaresti Risso, 1826
Harengula abbreviata Valenciennes, 1847
Clupea coval Cuvier, 1829
Clupea sinensis Linnaeus, 1758
Chatoessus tampo Valenciennes, 1848
Clupanodon motius Ham. Buch., 1822
Clupea vittargentea Lacepède, 1803
Clupea chrysoptera Lacepède, 1803

Opposition to the suppression of names as *nomina dubia* has been expressed from time to time (see for example comments on Opinion 749), but the names listed above pose the following problem. Each can be identified with various degrees of uncertainty with two or more known species, in each case pre-dating the commonly accepted name. The possibility of certain identification cannot be excluded, even though all now lack types; but in every case except *motius* and *jussieu*, the name would immediately become a *nomen oblitum* and would thus require the approval of the Commission before it could be used. On the other hand, there always remains the possibility that some or all of these represent undiscovered species. The stand taken here is that, in view of the extremely tangled nomenclature of the clupeoid fishes, any new species that may be described hereafter deserves a new name, proper description and extant type material. To attach one of these doubtful names to an existing species by provision of a neotype seems to be an unnecessarily arbitrary step which would make for no greater stability than to abandon the names altogether.

One name mentioned here, *Clupea ficta* Duhamel, 1772, is evidently non-binomial and should be rejected. Application has already been made by Svetovidov (1965).

The following generic names associated with Commerson, which were cited by but not adopted by Lacepède, are shown to be invalid (Opinion 89) :

Encrasicholus
Halex.

The generic name *Trichis*, associated with Plumier and cited by but not adopted by Lacepède, has not yet been ruled on by the Commission.

The generic name *Engraulis* probably dates from Bosc (1816), but application will be made to continue to attribute the name to Cuvier.

The type species of *Thryssa* Cuvier is shown to be *Clupea mystus* Linnaeus (= *Coilia mystus*), as first designated by Bory St. Vincent. Application will be made to continue to recognize *Clupea setirostris* Broussonet as type of this genus and thus prevent *Thryssa* from replacing *Coilia* for the rat-tailed anchovies.

Finally, the name *Engraulis grossidens*, usually attributed to Cuvier, is shown to be an Agassiz name, and eight other (non-clupeoid) names, which are cited by Spix & Agassiz as "Cuvier, in litt." should be attributed to Agassiz, or Spix, or to both authors.

* Considered a *nomen dubium* and suppressed by Opinion 749 (1965).

Family **DUSSUMIERIIDAE**

DUSSUMIERIA Valenciennes, 1847

= **DUSSUMIERIA** Valenciennes, 1847

Dussumieria Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 467 (Type: *Dussumieria acuta* Val.)

Although superficially resembling a herring, the absence of scutes in *Dussumieria acuta* led Valenciennes to re-examine his specimens more closely. From the high number of branchiostegal rays and the presence of teeth on the palatines, endo- and ecto-ptyrgoids and tongue, but absence of a gular plate, Valenciennes concluded that his genus should be placed between *Elops* and the Butyrins (*Albula*) (i.e. p. 316 in Vol. 19).

On the basis of Temminck & Schlegel's description of *Clupea micropus* (= *Etrumeus teres* (DeKay)), Valenciennes considered this a second species of *Dussumieria*, distinguished by its shorter anal.

Neither Lacepède nor Cuvier record specimens of *Dussumieria*, although according to Bertin (1940), nine of the paratypes of *D. acuta* collected by Dussumier were present in the museum two years prior to the publication of the 2nd edition of the *Règne Animal* (1829). If they had been examined by Cuvier, he would undoubtedly have noticed and commented on the absence of ventral scutes.

The genus *Dussumieria* was revised by Bertin (1943) and by Whitehead (1963a). At the present time only a single species is recognized, *D. acuta*.

1. ***Dussumieria acuta*** Valenciennes, 1847

= ***Dussumieria acuta*** Valenciennes, 1847

Dussumieria acuta Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 467, pl. 606 (Malabar coast, Coromandel coast; many fishes; Dussumier).

TYPE MATERIAL. MNHN. 3697, 2 fishes, 89.7–108.5 mm. S.L., ex Coromandel, coll. Dussumier (smaller one dissected to show vertebrae).

MNHN. 3694, 3 fishes, 87.0–87.3 mm. S.L., ex Malabar, coll. Dussumier.

MNHN. 3694, 4 fishes, 115.5–132.0 mm. S.L., ex Malabar, coll. Dussumier.

MNHN. 3217, 9 fishes, 69.0–123.5 mm. S.L., ex Malabar, coll. Dussumier.

All eighteen specimens are syntypes. From these, a moderately large specimen in fair condition has been chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish 108.5 mm. S.L. (139.3 mm. tot.l.), ex Coromandel, coll. Dussumier. Right maxilla cut, scales anterior to anal origin shed, pectoral tips broken, otherwise in fair condition, MNHN. 3697.

Br.St. 12, D v 16, P i 12, V i 7, A iii 11, g.r. 20.

In percentages of standard length : body depth 26.4, head length 28.0 ; snout length 8.7, eye diameter 7.4, upper jaw length 9.3, lower jaw length 13.5 ; pectoral fin length 12.9 (tip broken), pelvic fin length 9.2, length of anal base 10.6 ; pre-dorsal distance 57.2, pre-pelvic distance 64.0, pre-anal distance 81.5.

Body slightly compressed, rounded ventrally, its depth a little less than head length; snout a little greater than eye diameter. Posterior frontal fontanelles occluded. Lower jaw projects slightly when mouth closed; small conical teeth near dentary symphysis. Upper jaw slightly longer than snout, about reaching anterior eye border; maxilla moderately slender, lower edge with fine denticulations; two supra-maxillae present, also slender, the posterior about half as deep as expanded portion of maxilla. Pre-maxillae almost rectangular, not tapering laterally, outer edge with a single series of small conical teeth.

Lower border of operculum inclined at about $10-15^{\circ}$ to the horizontal; sub-operculum almost diamond-shaped. Pseudobranch exposed, moderate, its length just less than eye diameter. Gillrakers slender, about equal to length of corresponding gill filaments.

Dorsal fin with long basal scaly sheath; dorsal origin equidistant between caudal base and anterior eye border. Pelvic fin base below 7th branched dorsal ray, nearer to caudal base than to pectoral base by $\frac{1}{4}$ eye diameter. Anal fin with low basal scaly sheath; anal origin nearer to pelvic base than to caudal base by $\frac{1}{2}$ eye diameter. Caudal fin covered by small scales.

Scales: all now missing from body.

Vertebrae: Bertin (1943) records 53 vertebrae in the other of the two specimens in this bottle.

Figure: the figure given by Valenciennes (pl. 606—reproduced here, Plate 1a) is an accurate one except that it suggests ventral scutes no less trenchant than in his figures of scuted clupeids. The specimen is shown as fully scaled (about 46–47 in lateral series), the back blue-green, the lower two-thirds of the flanks silver, and the caudal margin dark brown. The fish is moderately deep-bellied (depth 25.7% of S.L.), as is the lectotype chosen here, but the snout is a little shorter than in the latter (8.8% of S.L.).

The drawing shows a fish of 113 mm. S.L., i.e. slightly larger than the lectotype, and Bertin (1943) believed that a specimen from bottle MNHN. 3694 was model for the drawing; he also suggested that the number of scales shown was arbitrary, and thus proof that they had already been shed. He identified the species represented as *Dussumieria hasseltii* and not *D. acuta* (see below).

IDENTIFICATION. In listing the types in Paris, Bertin (1940) stated that some of the 18 extant paratypes of *D. acuta* were in fact *D. hasseltii* Bleeker. Later, in his revision of the family Dussumeriidae (Bertin, 1943), he claimed that in fact only two of the paratypes (MNHN. 3697) were true *D. acuta*. Like Fowler (1941), Bertin recognized three species of *Dussumieria*, *D. acuta*, *D. hasseltii* and the Red Sea *D. productissima* Chabanaud, distinguished by differences in gillraker, anal finray and scale counts and in body depth. I have shown elsewhere (Whitehead, 1963a) that scales are too rarely retained (lost in all 18 paratypes) and the other characters too variable and prone to overlap when a large sample is examined, for more than a single species to be recognized. In the following table the lectotype (one of Bertin's two specimens of *D. acuta*), and paratypes of *D. acuta* are compared with Bertin's figures and with the putative neotype of Bleeker's *D. hasseltii*.

	depth % S.L.	snout % S.L.	head % S.L.	gillrakers				
Lectotype of <i>D. acuta</i> (MNHN.3697)	26.4	8.7	28.0	20				
Paratypes (range)	19.9-27.0	8.2-9.5	27.1-29.5	$\frac{21}{2}$	$\frac{22}{5}$	$\frac{23}{2}$	$\frac{24}{3}$	$\frac{25}{2}$
(mean)	24.1	8.8	28.1	22.85				
Bertin (1943)								
<i>D. acuta</i>	26-27	—	26-27	20-21				
<i>D. hasseltii</i>	21-26	—	25-27	22-24				
Type of <i>D. hasseltii</i> (BMNH.1867.11.8.21)	20.9	9.0	26.4	22				

Although the type of *D. hasseltii* is a more slender fish, there is a marked tendency for slender specimens to be found at the eastern and western limits of the range of this species (Red Sea to Japan), with deeper-bodied fishes near the centre (Whitehead, 1963a). In other respects, the type of *D. hasseltii* differs little from the lecto-type of *D. acuta*.

2. *Elops javanicus* Valenciennes, 1847
= *nomen nudum*

Elops javanicus Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 271 (on coloured unpublished drawing by Kuhl & van Hasselt with this same MS. name).

Van Hasselt (1823) referred to this fish but published no name : " van dit laatste genus (i.e. *Elops*) heb ik eene species, die van de vorige verschilt, door kootere bovenkaak en door eits vreemds onder de *Elophen* ; de Radii branchiostegi 14 in getal, daar gewoonlijk 30 en meer gevonden worden." (That is to say, it differs from *Elops* in having a shorter upper jaw and 14 rather than 30 or more branchiostegal rays.)

If the drawing and this description refer to the same fish, then it cannot have been a species of *Sardinella*, in which there are only 6-7 branchiostegal rays. Bleeker (1849) was probably correct in identifying *Elops javanicus* with *Dussumieria elop-soides* (= *D. acuta* Valenciennes) (Whitehead, *et alii*, 1966).

The fish collections and manuscript drawings of Kuhl and van Hasselt were sent to Leiden in 1824-25, destined for description by Cuvier and Valenciennes ; the latter visited Leiden at about that time for this purpose (see Alfred, 1961). It must be presumed that the figure of *Elops javanicus* seen by Valenciennes was the same as that referred to by Bleeker (*loc. cit.*), and that Valenciennes overlooked the reference to branchiostegal rays in the description. A similar difference of opinion arose over the Kuhl and van Hasselt drawing of "*Macrura*" (Whitehead, 1965a: 142).

Family **CLUPEIDAE**
Subfamily **CLUPEINAE**
CLUPEA Linnaeus, 1758

Clupea Linnaeus, 1758, *Syst. Nat.*, ed. 10 : 317 (Type : *Clupea harengus* Linnaeus).

Lacepède (1803) listed seventeen species in the genus *Clupea*, including members of the modern subfamilies Clupeinae and Alosinae, as well as engraulids, and a species

each of *Megalops*, *Chirocentrus* and *Albula* (Table 1). Two of the species of *Clupea* (*C. fasciata* and *C. tropica*) are probably not clupeoids, the second one being placed by Lacepède in a separate (but unnamed) subgenus in which the tail is “*rectiligne, ou arrondie, ou lancéolée et sans échancrure.*” Lacepède's genus *Clupea* seems at first sight to be the kind of compendium genus such as Günther (1868) used much later. But the erection of new genera, especially *Stolephorus* and *Clupanodon*, to accommodate fishes quite as “herring-like” as the elopoids and albuloids which he allowed to remain in *Clupea*, suggests that the latter genus was more in the nature of a box-room, inherited from Linnaeus, from which he removed and re-classified only a few of the contents.

Lacepède defined the genus *Clupea* as having : teeth in the jaws, more than three branchiostegal rays, a single dorsal fin, and a keeled belly, the keel being denticulated or sharp. He included the non-scuted *Engraulis*, *Pterengraulis*, *Megalops*, *Chirocentrus* and *Albula*, as well as the edentulous *Nematalosa* and *Clupanodon*, showing the extent to which he relied on the descriptions and figures of other authors.

Cuvier's concept of the genus *Clupea* is a considerable advance. Although Cuvier cited 33 species as “*Clupea*” (editions 1 and 2 of the *Règne Animal*, taken together), he only included 11 species (in the 2nd edition) under the heading “*Les Harengs proprement dits. (Clupea Cuv.)*” (Table 2). These 11 species are all clupeids, belonging to the subfamilies Clupeinae and Alosinae, with one Pristigasterinae (i.e. Russell's “*Ditchoe*”, of which he probably only knew the drawing).

Cuvier defined his genus *Clupea* as having : the maxillae arched in front, divisible longitudinally into many pieces, the opening of the mouth moderate, and the upper lip not notched (cf. *Alosa*). His more complete definition of the herrings in general (i.e. his “*Clupea* L.”), which included his genera *Clupea*, *Alosa* and *Chatoes-sus*) helped to eliminate many of the anomalies from Lacepède's “box-room”.

Valenciennes (1847: 28) placed nine species in the genus *Clupea* (see Table 3). He defined the genus principally on dentition, his species having small pre-maxillary teeth, denticulations on the maxilla so fine that they are more apparent to touch than to the naked eye, and small teeth on the dentary symphysis ; also the teeth on the vomer and tongue are larger, there are a few easily shed teeth on the outer border of the palatines, but none on the pterygoids. Six of Valenciennes' nine species of *Clupea* are *C. harengus*, and the other three are species of *Alosa* (the latter erroneously placed since he included the shads in his genus *Alausa*). *Clupea harengus* appears again in Valenciennes' genus *Rogenia*, which was based on young herrings.

3. *Clupea pallasii* Valenciennes, 1847 = *Clupea harengus pallasii* Valenciennes, 1847

Clupea pallasii Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 253 (on an 8 inch specimen in Berlin Museum, ex Kamtchatka, from Pallas Collection).

TYPE MATERIAL. No specimens in Paris.

IDENTIFICATION. Following Svetovidov (1952), this Valenciennes species is here recognized as a subspecies of *C. harengus* L., distinguished from the Atlantic sub-

species by its fewer vertebrae, less trenchantly keeled pre-pelvic scutes, fewer post-pelvic scutes and less developed vomerine teeth. Of these characters, the only one mentioned by Valenciennes is scute form (n'est pas très prononcée), but the provenance of the specimen confirms its identity.

ROGENIA Valenciennes, 1847

= **CLUPEA** Linnaeus, 1758

Rogenia Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 340 (Type : *Clupea alba* Yarrell=juvenile *Clupea harengus*).

Valenciennes, in common with other ichthyologists at that time, often confused the juveniles of the sprat and the herring, or else failed to recognize them, to the extent that ten of the species and four of the genera that he lists can be referred either to the sprat or the herring. Following the distinction made by Yarrell (1828) between the shad and the whitebait, Valenciennes proposed the genus *Rogenia* for the latter, characterized by : vomerine teeth present, and teeth present also on the pterygoids, palatines and tongue—C'est la clupée qui porte le plus grand nombre de dents, malgré sa petite taille. As noted under *Spratella* (p. 18), the vomer in *Sprattus sprattus* is rarely toothed (Svetovidov, 1963: 111).

The Valenciennes specimens extant in Paris are clearly young herrings (see below), and *Rogenia* falls into the synonymy of *Clupea*. Before arriving at his own system of clupeid genera, Bleeker (1852) followed that of Valenciennes based on dentition, and assigned his Indonesian specimens of *Escualosa thoracata* (Val.) to the genus *Rogenia*. Günther (1868: 416), having noted that the presence or absence of palatine teeth "is not a character fit for specific, and much less generic, distinction", dismissed the genus *Rogenia* with characteristic verbal economy—" *Rogenia* (!) *alba*, Cuv. & Val. XX, p. 341, pl. 598."

Bertin (1940) incorrectly listed the Valenciennes specimens as types, apparently unaware of *Clupea alba* Yarrell. These specimens are listed here, and one fully described, since they formed the basis of Valenciennes' genus *Rogenia*. It is most unlikely that a neotype would be required for Yarrell's species, but the measured specimen would be suitable.

4. ***Rogenia alba*** : Valenciennes, 1847

= ***Clupea harengus*** Linnaeus, 1758

Clupea alba Yarrell, 1829, *Zool. Journ.*, **4** : 137, 465, pl. 5, fig. 2 ; *Idem*, 1836, *Brit. Fish.*, 1st. ed., **2** : 117.

Rogenia alba : Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 341 (Thames ; many fishes ; Leach, Milne Edwards and Owen).

SPECIMENS. *MNHN.* 3713, 3 fishes, 41.6–77.8 mm. S.L., ex Thames, coll. Milne Edwards, in good condition.

MNHN. 3714, 9 fishes, 41.5–48.2 and 87.0 mm. S.L., ex Thames, coll. Owen, in fair condition.

DESCRIPTION. Based on the largest of the Owen specimens, 87.0 mm. S.L., caudal tips broken, some pre-pelvic scutes and scales on left side no longer present, MNHN. 3714.

Br.St. 9, D iii 16, P i 15, V i 7 (right) i 8 (left), A iii 14, g.r. 43, scutes 12 [?] 3 + 12, scales (indet.).

In percentages of standard length : body depth 25.4, head length 25.4 ; snout length 7.1, eye diameter 6.9, length of upper jaw 12.6, length of lower jaw 14.4 ; pectoral fin length 11.5 (tip broken), pelvic fin length 7.1, length of anal base 11.7 ; pre-dorsal distance 53.2, pre-pelvic distance 56.8, pre-anal distance 78.2.

Body moderately compressed, belly not sharply keeled, depth equal to head length. Snout a little greater than eye diameter. Articulation of lower jaw below vertical from posterior pupil border ; a few small conical teeth at dentary symphysis. Pre-maxillae triangular, edentulous. Maxilla with fine denticulations along lower edge ; two supra-maxillae present, the anterior about $\frac{1}{4}$ as deep as the posterior, the latter slightly pointed posteriorly, almost as deep as expanded portion of maxilla. Teeth present on tongue.

Posterior frontal fontanelles occluded. Pseudobranch present, exposed, its length equal to eye diameter. Gillrakers fine, slender, twice length of corresponding gill filaments. Pterotic bulla present, occupying about half of the pre-epiotic fossa.

Dorsal fin origin nearer to caudal base than to snout by $\frac{3}{4}$ eye diameter. Pelvic base nearer to anal origin than to pectoral base by $1\frac{3}{4}$ eye diameters ; under vertical from base of 4th branched dorsal ray. Anal base equidistant between caudal base and pelvic base.

IDENTIFICATION. The pelvic count, and especially the presence of a pterotic bulla, confirm that Valenciennes' specimens are young herrings. Svetovidov (1963), Hildebrand (1964) and others have all identified *Rogenia alba* with *Clupea harengus*.

***SPRATTELLA* Valenciennes, 1847**

= ***SPRATTUS* Girgensohn, 1846**

Sprattus Girgensohn, 1846, *Mém. savans étrangers Acad. Sci. Pétersb.*, 5 (Jan.) : 534 (Type :

Sprattus haleciformis Girgens. = *S. sprattus* Lin.).

Spratella Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 356 (Type : *Spratella pumila* Val. = *S. sprattus* Lin.).

Valenciennes distinguished this genus by the presence of teeth on the palatines and tongue (as opposed to pterygoids and tongue in *Clupeonia*, the preceding genus ; pterygoids only in the next genus, *Kowala*). In *Sprattus sprattus* there is a row of weak teeth on the palatines and on the mesopterygoid (Svetovidov, 1963), and according to Heinke (1898) the vomer is sometimes toothed also. The inadequacy of Valenciennes definition of *Spratella* is evident from the fact that his two included species are now placed in widely separated genera, *Sprattus* and *Sardinella*. It was almost forty years before the absence of a pterotic bulla in the skull of *Sprattus* was discovered (Mathews, 1884), a feature almost unique amongst clupeoids and now used to separate this genus from the superficially similar *Clupea* (Svetovidov, *loc. cit.* ; Whitehead, 1965c). Valenciennes seems to have had constant difficulty in separat-

ing young sprats from young herrings, at least to judge by his identifications of specimens still extant. As shown below, however, it is clear that *Spratella pumila* is *Sprattus sprattus*.

The juveniles of *Clupea harengus* and *Sprattus sprattus* are superficially very similar. They can be distinguished by the following key.

- 1 Pterotic bulla present ; pelvic count (17) 18 (19) ; pre-pelvic scutes not strongly keeled ; gillrakers 40-51 ***Clupea harengus***
- 2 Pterotic bulla absent ; pelvic count (15) 16 (17) ; pre-pelvic scutes trenchant ; gillrakers 30-41 ***Sprattus sprattus***

The presence or absence of a pterotic bulla can be determined quite simply by folding the extra-scapular backwards and teasing aside the musculature in the pre-epiotic fossa. The bulla itself is recognizable as a spherical rough-surfaced mass protruding into the lower half of the fossa.

5. ***Spratella pumila*** Valenciennes, 1847
= ***Sprattus sprattus*** (Linnaeus, 1758)

Clupea sprattus Linnaeus, 1758, *Syst. Nat.*, ed. 10 : 318 (Habitat in oceano Europeo).
Spratella pumila Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 357 (ex Calvados near Caen ; many fishes, 3½ inches).

TYPE MATERIAL. There are no bottles labelled *Spratella pumila* in Paris, and no types are listed by Bertin (1940). There are, however, three bottles of non-typical material (two labelled "*Engraulis* sp.", and the third hitherto unidentified) which contain specimens of *Sprattus sprattus* and which are marked as having been part of the Valenciennes collection. But since there is little doubt that *Spratella pumila* is a junior synonym of *Sprattus sprattus*, there is no purpose in selecting one of these fishes as neotype.

IDENTIFICATION. The trenchant scutes described by Valenciennes indicate that this species is *Sprattus sprattus*. It could only have been confused with *Clupea harengus* (pelvic rays 8-9 (10), belly not strongly keeled). Although Valenciennes misidentified his specimens on other occasions, this was partly because he did not realize that the pelvic count was diagnostic. Since he gives a count of only 7 for *Spratella pumila*, it must be accepted that his specimens were indeed *S. sprattus* and not *C. harengus*.

6. ***Clupea latulus*** Cuvier, 1829
= ***Sprattus sprattus*** (Linnaeus, 1758)

Clupea latulus Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 318.

TYPE MATERIAL. No specimens, description probably based on Schoneveld (1624).

IDENTIFICATION. Cuvier gives the synonymy of this species as " La Blanquette, Breitling des Allemands, White-Bite des Anglais. (*Clupea latulus*, N.) Schoneveld, p.41." Storey (1938), who cited Schoneveld's description of " De Latulo " in full, showed that the latter appears in the synonymy of the well-described Baltic *Clupea*

schoneveldii Krøyer, a species which authors have agreed is *Sprattus sprattus* (e.g. Günther, 1868: 419; Lilljeborg, 1891; Smitt, 1895). Günther, on the other hand, identified Cuvier's *Clupea latulus* as the herring, not the sprat. But Cuvier's description agrees much better with the more trenchantly scuted sprat: le corps plus comprimé, le ventre plus tranchant que le hareng . . . Sa dorsale est plus avancée, son anale plus longue, et approchant davantage de la caudale. There is some variation in the position of the dorsal origin in both the sprat and the herring, but the Baltic sprat has slightly more anal rays than the herring (14-18, mean 16.1; cf. 13-17, mean 15.0 according to Svetovidov, 1963); there is little difference between the anal position in the two species, however.

Clupea latulus Cuvier is here considered a junior synonym of *Sprattus sprattus*. The identity of Cuvier's species is no longer of such importance since Storey (*loc. cit.*) has shown that it is not the type of *Harengula* Valenciennes. In his description of *Harengula latulus*, Valenciennes makes no reference to Cuvier's species, possibly another indication that his contribution to the *Histoire Naturelle* was entirely his own. In fact, Valenciennes' specimens are a species of *Harengula*, a genus now known to be absent from the Eastern Atlantic (see p. 23).

MELETTA Valenciennes, 1847
= **SPRATTUS** Girgensohn, 1846

Meletta Valenciennes, 1847, *Hist. Nat. Poiss.*, **20**: 366 (Type: *Meletta vulgaris* Val. = *Sprattus sprattus*).

Of the 11 clupeoid genera erected by Valenciennes on the basis of dentition, *Meletta* is one of the most artificial and heterogeneous. The eleven species included are now distributed between no less than seven genera (*Sprattus*, *Herklotsichthys*, *Sardinella*, *Escualosa*, *Opisthonema*, *Alosa* and *Ethmidium*). Valenciennes considered *Meletta* the last in the series of toothed clupeids (teeth on tongue only) before reaching the edentulous shads (his *Alausa*).

Two of Valenciennes species of *Meletta* can be referred to *Sprattus*, *M. vulgaris* and *M. novaehollandiae*.

Bleeker (1872) used the name *Meletta* as a subgenus of *Clupea* in the caption to his figure of *Clupea (Harengula) schrammi* in the Atlas (Plate 272), having evidently rejected it between the completion of the plates and the publication of the Atlas text. Günther (1868: 412) had no hesitation in placing *Meletta*, together with eight other clupeid genera used by Valenciennes, in his synonymy of *Clupea*; he had, however, previously described the gizzard-shad *Signalosa petenense* as a member of *Meletta* (Günther, 1866). The name *Meletta* has otherwise been little used.

7. **Meletta vulgaris** Valenciennes, 1847
= **Sprattus sprattus** (Linnaeus, 1758)

Meletta vulgaris Valenciennes, 1847, *Hist. Nat. Poiss.*, **20**: 367 (ex La Rochelle and Caen; many specimens; d'Orbigny, and Eudes Deslongchamps & Fourneaux).

TYPE MATERIAL. *MNHN*. 3717, 2 fishes, 81.8-98.5 mm. S.L., ex La Rochelle (Charente-Maritime), coll. d'Orbigny.

There are no specimens in Paris which can be definitely identified as the Caen specimens, but these may well be amongst the several bottles of *Sprattus* and *Clupea* dating from the time of Valenciennes but not properly named (see p. 19).

The larger of the two La Rochelle syntypes is here chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 98.5 mm. S.L., *ex* La Rochelle, coll. d'Orbigny, in good condition, MNHN 3717.

Br.St. 6, D v 14 (1st simple ray minute), P i 6, V i 6 (both sides), A iii 17, g.r. 36, scutes 22 + 12, scales (indet.).

In percentages of standard length : body depth 21.3, head length 22.5 ; snout length 6.6, eye diameter 7.0, length of upper jaw 10.6, length of lower jaw 11.4 ; pectoral fin length 16.6, pelvic fin length 10.5, length of anal base 14.2 ; pre-dorsal distance 58.0, pre-pelvic distance 56.0, pre-anal distance 77.8.

Body compressed, belly keeled. Snout a little shorter than eye diameter. Lower jaw with very fine conical teeth at symphysis (barely apparent). Premaxillae triangular, without teeth. Maxilla with very fine denticulations along lower edge ; two supra-maxillae present, the anterior about $\frac{1}{4}$ as deep as posterior, the latter slightly pointed posteriorly, about as deep as expanded portion of maxilla. Teeth present on tongue.

Pseudobranch present, exposed, its length $\frac{7}{8}$ of eye diameter. Gillrakers fine, slender, $1\frac{1}{2}$ times length of corresponding gill filaments and about $\frac{2}{3}$ eye diameter. (Absence of pterotic bulla not checked.)

Dorsal fin origin equidistant between caudal base and anterior eye border, i.e. nearer to caudal base than to snout tip by $1\frac{3}{4}$ eye diameters. Pelvic base in front of vertical from dorsal origin by $\frac{1}{4}$ eye diameter, nearer to anal origin than to pectoral base by $\frac{1}{2}$ eye diameter. Anal origin equidistant between caudal base and pelvic base.

8. *Meletta novae-hollandiae* Valenciennes, 1847

= *Sprattus novaehollandiae* (Valenciennes, 1847)

Meletta novae-hollandiae Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 376 (Port Jackson ; no mention of specimens ; Quoy & Gaimard).

Clupea (Pomolobus) bassensis McCulloch, 1911, *Zool. Res. Endeavour*, 1 : 16, pl. 4, fig. 13 (Bass Strait and Tasmania).

Clupea bassensis : Regan, 1917, *Ann. Mag. nat. Hist.*, (8) 18 : 5 (Hobart ; key to related species) ; Norman, 1936, *Ann. Mag. nat. Hist.*, (10) 17 : 492 (key to related species).

(Notes on this synonymy are given below.)

TYPE MATERIAL. MNHN. 9312, 1 fish, 94.5 mm. S.L., *ex* Port Jackson, New South Wales, coll. Quoy & Gaimard (1820).

DESCRIPTION. *Holotype*, a fish of 94.5 mm. S.L., in poor condition, caudal tips broken, snout and upper jaws mostly detached, many scutes and most scales missing, anterior dorsal and some anal rays damaged, MNHN 9312.

Br.St. (indet.), D iii 15 or iv 14, P i 14, V i 7 (left) ? i 6 (right), A iii 17, g.r. 39, scutes 9 [. .] 5 + 10 [? 1], scales (indet.).

In percentages of standard length : body depth 20.9, head length 25.4 (estimated), snout length (damaged), eye diameter 6.8, length of upper jaw (damaged), length of

lower jaw 13.4 ; pectoral fin length 13.2, pelvic fin length 8.4, length of anal base 16.5 ; pre-dorsal distance 54.5, pre-pelvic distance 56.5, pre-anal distance 74.5.

Body compressed, but belly not sharply keeled, depth a little less than head length. Maxilla (damaged) ; 2nd (posterior) supra-maxilla lozenge-shaped as in *Sprattus sprattus*. Posterior frontal fontanelles occluded ; no wedge-shaped fronto-parietal areas.

Pseudobranch present, exposed, its length equal to eye diameter. Gillrakers fine, slender, $1\frac{3}{4}$ times corresponding gill filaments, $\frac{3}{4}$ eye diameter. Posterior margin of gill opening without bilobed dermal appendages on cleithrum, but cleithral lobe present. Pterotic bulla absent.

Dorsal fin origin equidistant between caudal base and anterior border of eye. Pelvic base nearer to anal origin than to pectoral base by $1\frac{1}{2}$ eye diameters ; lying exactly below 1st unbranched dorsal ray. Anal origin nearer to pelvic than to caudal base by $\frac{3}{4}$ eye diameter ; last two anal rays normal, not enlarged.

IDENTIFICATION. The four Southern Hemisphere species of *Sprattus* have been placed in two groups (Whitehead, 1965c : 327).

- 1 Scutes prominent, sharply keeled ; vomer toothed
 - S. antipodum* (Hector)—Australia, New Zealand
 - S. muelleri* (Klunzinger)—New Zealand
- 2 Scutes not prominent, feebly keeled ; vomer edentulous
 - S. bassensis* (McCulloch)—Australia
 - S. fuegensis* (Jenyns)—S. America

There is now no possibility of checking the presence or absence of vomerine teeth in the holotype of *Meletta novaehollandiae*, but the scutes are certainly only feebly keeled and there can be little doubt that Valenciennes' species is a senior synonym of *S. bassensis*. The latter is separated from *S. fuegensis* solely on its fewer vertebrae—45 (46) 47 ; cf. (49) 50, and future work may show that the two are merely sub-species.

Bertin (1944) showed that the species name *novae-hollandiae* had been (wrongly) used for a species of *Hyperlophus* by Castelnau (1872) and also for a species of *Potamalosa* by Günther (1868), both authors being unaware that the dorsal scutes characteristic of these two genera are not present in the holotype of *Meletta novae-hollandiae*. Bertin, therefore, suggested that the name *novae-hollandiae* be dropped in favour of the name *bassensis*. However, there seems little reason to do this, for it is a situation so common in clupeoid nomenclature that a strict adherence to priority is preferable.

HARENGULA Valenciennes, 1847
= **HARENGULA** Valenciennes, 1847

Harengula Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 277 (Type : *Harengula latulus* Val. = *Clupea clupeola* Cuvier).

By original designation (Valenciennes, 1847, pp. 277 and 281) the type of *Harengula* is the Harengule Blanquette, *Harengula latulus* Valenciennes. Valenciennes noted that the Channel fishermen, while distinguishing several species amongst their catches

of "Blanquette", employed a number of terms for them, which apparently did not always correspond with the same species in different areas. His *Harengula latulus*, he asserts, is the Blanquette of the Caen fishermen, and one of the seven syntypes is labelled Caen, the rest being from Dieppe. Since *Clupea latulus* Cuvier is almost certainly *Sprattus sprattus* (Lin.) (see p. 19), and since Valenciennes' second species of *Harengula*, *H. sprattus*, is also the European sprat, it would seem at first sight that *Harengula latulus* Valenciennes is yet another nominal species based on *Sprattus sprattus*.

Here, however, a difficulty arises: the syntypes of *Harengula latulus* Valenciennes all possess a toothed hypomaxilla, a feature unique to a group of species in the Clupeinae which are confined to the Western Atlantic and Eastern Pacific (i.e. *Harengula sensu* Storey, 1938, Rivas, 1964, etc.). Subsequent authors are quite agreed that no member of this group has yet been recorded from European coasts, and no other European specimens are known in spite of Valenciennes' assertion that they are caught "en grande abondance" along the coasts of Picardy and Normandy. Storey (1938) and others have rightly concluded that the types were mislabelled, presumably in the time of Valenciennes since the description fits them fairly accurately.

Storey (*loc. cit.*) discusses whether the type of *Harengula* should be *Clupea latulus* Cuvier, and whether *Harengula latulus* Valenciennes was based on Cuvier's species. She discounts both ideas, however, and follows Gill (1861), Jordan & Gilbert (1882) and finally Jordan (1919) in recognizing *Harengula latulus* Valenciennes as type of *Harengula*, arguing that Valenciennes made no direct reference to Cuvier's species. In one place, Valenciennes (p. 278) speaks of making a careful examination of "examples" which Cuvier (1829: 318) united under the heading "Melet, Esprot ou Harenguet, Sprat des Anglais" (i.e. all placed in Cuvier's *Clupea sprattus*), finding differences in dentition, and identifying them as:

Melet = Melette = *Meletta* sp., presumably *M. vulgaris*

Esprot = Harengule esprot = *Harengula sprattus*

Harenguet = young herring, *Clupea harengus*.

Further on, Valenciennes distinguished between the Blanquette and the White-Bait, which Cuvier had combined (together with the German name Breitling) in his synonymy of *Clupea latulus*, but Valenciennes does not refer specifically either to Cuvier's description nor possible specimens. In this case Valenciennes clearly restricted his own *Harengula latulus* to the Blanquette element in Cuvier's *Clupea latulus*, by implication identifying Cuvier's White-Bait element as *Rogenia alba* Val. (now a synonym of *Clupea harengus*). This restriction would only be significant in the present context if it could be shown that the types of *Harengula latulus* Valenciennes, from "Caen" and "Dieppe", were part of the Blanquette element examined by Cuvier. But although these specimens were, according to Bertin (1940: 289), present in the Paris collections some years before the publication of the name *Clupea latulus* Cuvier, 1829, there is no proof whatever that they contributed to Cuvier's description of the species.

In fact, few authors have cited Cuvier's *Clupea latulus*, and none have suggested that it is type of *Harengula*. In the absence of type material, it can only be assumed

to have been a European species, most probably the sprat and not the herring (see p. 19). Following Storey, it is accepted here that, whatever errors have occurred in labelling of the types of *Harengula latulus* Valenciennes, that species should continue to be regarded as type of *Harengula*. A further reason for accepting this is that only one of Valenciennes' ten species of *Harengula* is from European waters, i.e. *Harengula sprattus*, all the rest being Indo-Pacific or Western Atlantic.

Valenciennes defined his genus *Harengula*, as usual, on dentition (teeth in jaws, on tongue, palatines and pterygoids), the pterygoid teeth separating it from the closely related *Sardinella*. Regan (1917b), like Valenciennes, included New World and Old World species in the genus *Harengula*, but the discovery of toothed hypomaxillae in the former (Berry, 1964a, b) has led to generic separation of the latter under the name *Herklotsichthys* Whitley (Whitehead, 1964a and c). Of the ten species of *Harengula* listed by Valenciennes, three can be referred to *Harengula*, four to *Herklotsichthys*, one is *Sprattus sprattus*, and the last may have been a species of *Sardinella*. Once again, Valenciennes was misled by dentition.

Identification of the true Valenciennes *Harengula* material has been made according to the keys of Storey (1938) and Rivas (1950 and 1963). Three species are involved, *H. humeralis* (Cuvier), *H. clupeiola* (Cuvier) and *H. pensacolata* Goode & Bean.

9. *Clupea clupeiola* Cuvier, 1829
= *Harengula clupeiola* (Cuvier, 1829)

Clupea clupeiola Cuvier, 1829, *Règne Animal*, 2nd ed.: 318 (footnote, on Cailleu, Duham, III. pl. 31, fig. 3) ; *Idem*, 1843, *ibid*, *Disciples* ed.: 274 (footnote, as before).

Harengula clupeiola: Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 289 (Antilles ; many fishes ; collector not mentioned).

TYPE MATERIAL. There are Paris specimens examined by Valenciennes and, according to Bertin (1940: 289), some at least were received from Martinique some nine years before Cuvier's description of *Clupea clupeiola*. The latter specimens are not mentioned by Cuvier, but the largest is suitable as a neotype should such become necessary. Since there is here, unlike in the next species, no doubt but that *clupeiola* of Valenciennes refers to the same species as *clupeiola* of Cuvier, the remaining specimens acquired after publication of Cuvier's name have no possible type status, contrary to Bertin's list. The extant Valenciennes material comprises fourteen specimens.

MNHN. 3379, 2 fishes, 107.5–115.9 mm. S.L., ex Martinique, coll. Plée (1820).

MNHN. 3237, 9 fishes, 82.2–98.1 mm. S.L., ex Martinique, coll. Bélanger (1829).

MNHN. 928, 3 fishes, 66.1–67.5 mm. S.L., ex Guadeloupe, coll. l'Herminier (no date ; the low registration number does not appear to be an indication of an early date).

DESCRIPTION. The following specimen is selected as a putative neotype should the need arise.

Putative neotype, a fish 115.9 mm. S.L., ex Martinique, coll. Plée, in excellent condition, MNHN. 3379.

Br.St. (n.r.), D iv 15, P i 13, V i 7, A iii 15, g.r. 32, scutes 17 + 15, scales (n.r.).

In percentages of standard length : body depth 28.7, head length 28.6 ; snout length 7.8, eye diameter 9.5, length of upper jaw 13.4, length of lower jaw 14.0 ; pectoral fin length 18.9, pelvic fin length 11.8, length of anal base 13.8 ; pre-dorsal distance 46.7, pre-pelvic distance 52.8, pre-anal distance 81.6. Dorsal origin to eye centre 34.5.

Body compressed, belly keeled, body depth equal to head length. Snout shorter than eye diameter. Maxilla with fine row of denticulations along lower edge ; two supra-maxillae, the posterior with lower part of expanded portion larger than upper ; toothed hypo-maxillae present. A single row of fine teeth on pre-maxillae. About 8 small conical teeth at dentary symphysis. Small teeth present on tongue, and ecto- and endo-pterygoids.

Pseudobranch present, exposed, its length $\frac{4}{5}$ of eye diameter. Gillrakers fine, slender, equal to length of corresponding gill filaments, just under 1 eye diameter ; short gillrakers present on posterior face of 3rd epibranchial. Fronto-parietal region with cuneiform area on each side bearing 5-6 longitudinal striae.

Dorsal fin origin nearer to snout than to caudal base by almost 1 eye diameter. Pectoral fin tips failing to reach pelvic base by $\frac{4}{5}$ eye diameter. Pelvic fin base below vertical from 6th branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{2}$ pupil diameter. Anal origin nearer to caudal than to pelvic base by 1 pupil diameter.

Pre-dorsal scales crenulated posteriorly ; ventral pre-pectoral scales with well-marked finger-like processes on posterior edge ; scales along flank with one large and 1-3 finer continuous vertical striae, the striae being less numerous anteriorly.

COLOUR : silver on flanks grading to slate colour on back ; fins hyaline ; no dark humeral spot.

Note. The high gillraker and scute counts in this specimen distinguish it from *Harengula humeralis* (Cuvier), and it must be assumed that the humeral spot has now faded. Gillraker counts in the other Valenciennes specimens from Martinique (MNHN. 3237) were 30 (three fishes) and 31 (six fishes).

Cuvier (1829: 318) based his name *Clupea clupeola* on " Le Cailleu, Duham., sect. III, pl. xxxi, f. 3 ", a reference to Duhamel du Monceau's *Traité Général des Pêches*. In fact, Cuvier (correctly) cited Duhamel's figure 3 of plate 31 in his list of species of *Chatoessus*, equating it with Bloch's *Clupea thrissa*. He obviously meant to cite figure 2 of plate 31 (labelled " Petit Cailleu ") in his synonymy of *Clupea clupeola*. Duhamel's figure (shown here, Plate 2c) was made from a drawing by Barbotteau and Duhamel's description of " Du petit Cailleu, Sardina Caribearum exilis " is also from Barbotteau. Storey (1938) reproduced both Duhamel's plate and Barbotteau's excellent description, and showed that they certainly refer to the Caribbean species now accepted as *Harengula clupeola* (Cuvier).

Valenciennes, in his description of *Harengula clupeola*, mentions Duhamel's figure and Barbotteau's description, but not Cuvier's *Clupea clupeola*. This is the only one of the three Cuvier *Harengula* species in which the Valenciennes specimens can be identified as the same species as Cuvier intended.

10. *Harengula latulus* Valenciennes, 1847
 = *Harengula clupeola* (Cuvier, 1829)

Harengula latulus Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 280, pl. 595 (coasts of Picardy and Normandy ; $3\frac{1}{2}$ –4 inch specimens ; no details of collector).

TYPE MATERIAL. MNHN. 931, 1 fish, 64.7 mm. S.L., *ex* Caen (Calvados), coll. Lamouroux (1824).

MNHN. 3236, 5 fishes, 64.7–76.2 mm. S.L., *ex* Dieppe, coll. Valenciennes (1827). Stanford Natural History Museum 32769, 1 fish, 74.2 mm. S.L., *ex* Dieppe, coll. Valenciennes (*ex* MNHN. 3236, sent as gift—see Storey, 1938: 37).

The true provenance of all these specimens is not known. The range of *H. clupeola* is from Florida to Brazil, and the specimens could have derived from any of a number of collections from this area sent to Paris in the early 19th century. The types of *Harengula maculosa* are now missing (not recorded by Bertin, 1940), and it is tempting to suggest the reason ; but Valenciennes' specimens of *H. maculosa* were too big (6 inches) to have been the present types of *H. latulus*.

DESCRIPTION. Because the species is type of an important and currently recognized genus, and because it is accepted as distinct from Cuvier's *Clupea latulus* (see below), a specimen is here chosen as lectotype and the remainder designated paralectotypes (the measurements for the two largest paralectotypes are given in parentheses).

Lectotype, a fish 64.7 mm. S.L., *ex* Western Atlantic (presumed), somewhat dessicated, MNHN. 931.

Paralectotypes, 2 fishes, 75.5 and 76.2 mm. S.L. (measured here) + 3 fishes, 64.7–67.8 mm. S.L. (not measured except for scute and gillraker counts), *ex* Western Atlantic (presumed), MNHN. 3236.

Br.St. 6, D iv 14 (iii 14, iv 15), P i 13 (i 14), V i 7, A iii 15 (iii 15), g.r. 32 (32, 32, 31, 30, 30), scutes 17 + 13 (17 + 14 in four, 17 + 15 in one), scales (indet.).

In percentages of standard length : body depth 28.0 (28.7, 29.8), head length 30.2 (28.1, 27.7) ; snout length 9.0 (7.5, 7.4), eye diameter 11.1 (9.2, 9.4), length of upper jaw 15.0 (12.9, 13.2), length of lower jaw 15.7 (14.2, 14.6) ; pectoral fin length 18.9 (damaged, 16.4), pelvic fin length 12.2 (10.3, 10.5), length of anal base 14.2 (13.1, 14.3) ; pre-dorsal distance 50.1 (44.8, 47.1), pre-pelvic distance 54.0 (53.3, 51.5), pre-anal distance 78.5 (79.0, 78.2).

Body compressed, belly keeled, body depth about equal to head. Eye larger than snout length. Maxillae with fine denticulations along lower edge ; two supra-maxillae, the posterior with lower part of expanded portion larger than upper ; toothed hypo-maxillae present. Fine teeth in a single series on pre-maxillae. About six small conical teeth at dentary symphysis. Small teeth present on tongue endo- and ecto-ptyergoids.

Pseudobranch present, exposed, its length $\frac{3}{4}$ eye diameter. Gillrakers fine, slender, $1\frac{1}{4}$ times length of corresponding gill filaments, about $\frac{1}{2}$ eye diameter ; short gillrakers present on posterior face of 3rd epibranchial. Fronto-parietal region with a cuneiform area on each side bearing 3–4 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{1}{2}$ eye diameters. Pectoral fin tips failing to reach pelvic base by almost 1 eye diameter. Pelvic fin

base below vertical from 5th branched dorsal ray, nearer to pectoral base than to anal origin by 1 pupil diameter. Anal origin nearer to pelvic than to caudal base by 1 pupil diameter.

Pre-dorsal scales crenulated ; ventral pre-pectoral scales with finger-like processes on posterior edge ; scales along flank with one large and 1-3 finer continuous vertical striae, the striae being less numerous anterior to the pelvic base.

Note. *Harengula latulus* Valenciennes is here considered to be quite distinct from *Clupea latulus* Cuvier.* There is no direct evidence to the contrary, and because of the error of locality labelling, this procedure simplifies the problem of the type of *Harengula*. In the case of *Harengula clupeiola* Valenciennes, it is assumed by all authors that this is identical to Cuvier's *Clupea clupeiola*, and the specimens do not contradict this. But Storey (1938) and Rivas (1964) identify *Harengula humeralis* Valenciennes with a species different from Cuvier's *Clupea humeralis*, and here the types bear this out. It must be accepted, therefore, here as elsewhere, that because Cuvier's descriptions are never stated to be based on specimens but on descriptions and figures, and because Valenciennes rarely makes reference to Cuvier's names ; and finally, because the identity of the Cuvier species is often far less certain than those of Valenciennes ; then it is sometimes preferable to take the name from Valenciennes and to leave the Cuvier name as a doubtful name, at least for the present.

The present specimens agree with both the putative neotype of *Harengula clupeiola* and with the descriptions of Rivas (1964). The figure given by Valenciennes (shown here as Plate 1c) hints at the presence of a toothed hypomaxilla and the figure is not inconsistent with *Harengula clupeiola*.

II. *Clupea humeralis* Cuvier, 1829 = *Harengula humeralis* (Cuvier, 1829)

Clupea humeralis Cuvier, 1829, *Règne Animal*, 2nd ed.: 318 (footnote, on *Sardine de la Martinique*, Duham., III, plate 31, fig. 4) ; *Idem*, 1843, *ibid*, *Disciples ed.*: 274 (footnote, as before).

TYPE MATERIAL. Cuvier mentioned no specimens and it is best to assume that the Paris specimens (undated) did not form part of Cuvier's description since these belong to another species (see below).

IDENTIFICATION. *Clupea humeralis* Cuvier was based on Duhamel's "Sardine des Antilles", the description and original drawing for the figure being by Barbotteau,† as in the preceding species. Storey (1938) reproduced both figure and description, and considered both to be fully descriptive of her *Harengula humeralis* material ; Rivas (1964) agreed. The Duhamel figure is shown here (Plate 2d).

Valenciennes (1847 : 294) mentioned Duhamel's description and figure of the Sardine des Antilles, and believed that his own *Harengula humeralis* was, *sans contredit*, the same. However, Valenciennes' specimens do indeed contradict this

* Because Valenciennes makes no reference to Cuvier in the text, the name is not disqualified under Art. 49 of the International Code.

† Conseiller au Conseil Supérieur in the Colony of Guadeloupe.

(see below). Valenciennes here makes one of his rare references to a Cuvier name (i.e. *Clupea humeralis*).

Storey based her description of *Harengula humeralis* (Cuvier) on 42 specimens from St. Lucia, British Honduras, Jamaica, Florida Keys and the Bahamas. The type locality for *H. humeralis* is Guadeloupe, although Cuvier speaks of this species as the "Sardine de la Martinique". From the specimens examined by Storey, one has been chosen from Jamaica for description here. This specimen would be suitable for neotype designation when the genus is next revised.

DESCRIPTION. *Putative neotype*, a fish of 103.0 mm. S.L., ex Jamaica, coll. Roberts, in good condition but with scales shed, a metal tag attached to lower jaw, Stanford University collection, No. 5041.

Br.St. 6, D iii 14, P i 13, V i 7, A iii 15, g.r. 15 + 27, scutes 16 + 11, scales (indet.).

In percentages of standard length: body depth 34.9, body width 13.2, head length 32.2; snout length 9.4, eye diameter 11.4, length of upper jaw 15.4, length of lower jaw 17.0; pectoral fin length 21.5, pelvic fin length 13.4, length of anal base 15.9; pre-dorsal distance 47.5, pre-pelvic distance 60.5, pre-anal distance 80.0.

Body compressed, belly keeled, width of body 2.6 times in its depth, the latter a little greater than head length. Snout length a little shorter than eye diameter. Maxillae with fine denticulations along lower edge, as also on hypo-maxillae; pre-maxillae edentulous; two supra-maxillae, the posterior with lower part of expanded portion larger than upper part. Dentary symphysis with about six cavities on each side which appear to have held teeth. Small teeth present on tongue, palatines and endo- and ecto-pterygoids.

Pseudobranch present, exposed, its length $\frac{1}{2}$ eye diameter. Gillrakers moderate, the longest a little over $\frac{1}{2}$ eye diameter and slightly greater than longest gill filaments; about 11 short gillrakers present on the posterior face of the 3rd epibranchial. Fronto-parietal region with a cuneiform area on each side bearing 5 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{1}{2}$ eye diameter. Pectoral fin tips failing to reach pelvic base by $\frac{1}{2}$ eye diameter, lying just below vertical from dorsal origin; an axillary scale present on the left side, $\frac{1}{3}$ length of fin. Pelvic fin base below vertical from 5th branched dorsal ray, nearer to anal origin than to pectoral origin by just over $\frac{1}{4}$ eye diameter. Anal origin equidistant between pelvic and caudal bases.

COLOUR: upper $\frac{1}{3}$ th of body brown, remainder of flanks silvery. Fins hyaline except for marked brown tip to dorsal.

12. *Harengula maculosa* Valenciennes, 1847
= *Harengula humeralis* (Cuvier, 1829)

Harengula maculosa Valenciennes, 1847, *Hist. Nat. Poiss.*, 20: 292 (Martinique; some fishes, 6 inches long; Plée, Achard & Garnot).

SPECIMENS. According to Storey (1938), Chabanaud was unable to find the types of *Harengula maculosa*, and they do not appear in Bertin's list. In spite of a thorough search during the present study, the types are still missing. As stated already, the

missing types are not those that are now attributed to *Harengula latulus*. There does not seem to be much gained by designating a neotype for this species.

IDENTIFICATION. Storey (1938) and Rivas (1950 and 1964) both concluded that this species was merely a synonym of *Harengula humeralis*. Valenciennes distinguished it by its more pointed snout, greater number of transverse grooves on the scales, 27 scutes and larger size, all of which are consistent with *H. humeralis*.

***Harengula humeralis*: Valenciennes, 1847**
= *Harengula pensacolae* Goode & Bean, 1879

Harengula humeralis Valenciennes, *Hist. Nat. Poiss.*, **20** : 293 (coasts of South America, from Rio Janeiro to the Antilles ; many specimens ; Delalande, Labadie, l'Herminier, Ricord).

Harengula pensacolae Goode & Bean, 1879, *Proc. U.S. nat. Mus.*, **2** : 152 (Pensacola, Florida) ; Rivas, 1964, *Fish. W. N. Atlantic*, **3** : 393.

Harengula majorina Storey, 1938, *Stanford Ichthy. Bull.*, **1** (1) : 32, figs. 9, 12, 17 (*H. humeralis* Val. in synonym ; West Indies and Brazil).

SPECIMENS. MNHN. 3239, 3 fishes, 86.4–92.8 mm. S.L., ex St. Domingo, coll. Ricord (undated).

MNHN. 911, 4 fishes, 81.3–87.5 mm. S.L., ex Brazil, coll. Delalande (undated).

MNHN. 3381, 4 fishes, 95.7–112.5 mm. S.L., ex Bahia, coll. Labadie.

Valenciennes also mentions fishes sent from Guadeloupe by l'Herminier, but these are not extant and were not listed by Bertin (1940) ; these may be the specimens listed here and by Bertin under *Harengula clupei* (MNHN. 928, 3 fishes, ex Guadeloupe).

The best of the Bahia fishes is described here.

DESCRIPTION. Based on a fish of 107.7 mm. S.L., ex Bahia, coll. Labadie, in good condition, bearing paper tag, MNHN. 3381.

Br.St. 6, D iv 13, P i 13, V i 6 (i 7 right), A ii 15, g.r. 34, scutes 17 + 13.

In percentages of standard length : body depth 34.5, head length 29.4 ; snout length 7.9, eye diameter 10.2, length of upper jaw 14.2, length of lower jaw 14.6 ; pectoral fin length 20.2, pelvic fin length 12.4, length of anal fin base 13.5 ; pre-dorsal distance 46.5, pre-pelvic distance 55.0, pre-anal distance 80.5.

Body moderately compressed, its width $2\frac{3}{4}$ times in its depth, belly keeled, body depth a little greater than head length. Snout less than eye diameter. Maxillae with fine denticulations along lower edge ; two supra-maxillae, the posterior with lower part of expanded portion larger than upper ; toothed hypo-maxillae present. A single series of fine conical teeth on pre-maxillae. About 14 small conical teeth at dentary symphysis. Small teeth present on tongue, palatines and endo- and ecto-ptyergoids.

Pseudobranch present, exposed, $\frac{3}{4}$ eye diameter. Gillrakers fine, slender, equal to length of corresponding gill filaments, $\frac{1}{2}$ eye diameter. Fronto-parietal region with a cuneiform area on each side bearing 4–6 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by just over one eye diameter. Distance between dorsal origin and eye centre 1 mm. less than body depth. Pectoral fin tips failing to reach pelvic base by $\frac{1}{2}$ eye diameter. Pelvic base

below vertical from 7th branched dorsal ray, just nearer to pectoral base than to anal origin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{3}$ eye diameter.

Scales adherent ; pre-dorsal scales with crenulated posterior borders ; ventral pre-pectoral scales with posterior finger-like processes ; scales along flank with one large and 1-5 finer continuous vertical striae, the latter becoming less numerous anteriorly.

COLOUR : upper $\frac{1}{3}$ of body slate coloured, remainder golden with the appearance of 7 lighter longitudinal lines along the scale rows ; no humeral spot.

Measurements were also made on the three St. Domingo specimens (MNHN. 3239) and four Brazilian specimens (MNHN. 911). Figures for the St. Domingo fishes are given in parentheses.

Br.St. 6, D iii-iv 14 (iii 14-15), P i 13-14 (i 12-14), V i 7 (i 7), A ii-iii 15 (ii-iii 13-14), g.r. 30, 32, 32, 33 (33, 34, 35), scutes 17-18 + 13-14 : total 30-31 (17 + 12-13 : total 29-30).

In percentages of standard length : body depth 32.8-34.9 (31.4-32.7), head length 26.4-27.8 (27.7-28.4) ; snout length 6.8-7.6 (6.9-7.4), eye diameter 8.6-9.9 (8.9-9.5), length of upper jaw 13.3-13.4 (13.6-14.0), length of lower jaw 12.8-13.6 (14.2-14.3) ; pectoral fin length 18.4-19.9 (20.5-20.6), pelvic fin length 12.8-13.4 (11.9-13.4), length of anal base 13.6-16.7 (12.9-13.5) ; pre-dorsal distance 43.0-45.7 (45.2-47.2), pre-pelvic distance 47.4-53.8 (54.0-55.3), pre-anal distance 78.4-81.0 (79.9-81.0).

IDENTIFICATION. *Harengula humeralis* Valenciennes is clearly not *Clupea humeralis* Cuvier, and the Valenciennes name must be accepted as a misidentification and not a homonym since Valenciennes definitely included reference to Cuvier's name in his text (p. 295). The true identity of Valenciennes' *H. humeralis* is of interest since it was considered by Storey (1938) to be a member of her new species, *Harengula majorina* (= *H. pensacolae majorina* of Rivas, 1950, 1964). Unfortunately, the differences separating *H. pensacolae* from *H. clupeola* are not large, and the Valenciennes specimens sometimes lie within the range of overlap between the two species in such characters as gillrakers and scute numbers and in body depth.

The most recent review of the Western Atlantic and Caribbean species of *Harengula* (but excluding the South American forms) is that of Rivas (1964), based mainly on his earlier study of the genus (Rivas, 1950). Rivas separated *H. pensacolae* from *H. clupeola* chiefly on its higher gillraker count : 30-40, usually 32-39, as against 28-34, usually 30-32 in *H. clupeola*. He also described *H. pensacolae* as a slightly deeper fish (depth 29.5-34.7 per cent. of S.L., against 29.5-32.0 in *H. clupeola*), with a slightly shorter upper jaw (12.9-13.8 per cent. of S.L., against 13.0-15.8 per cent. in *H. clupeola*). Finally, Rivas (1950) found the distance dorsal origin to eye centre usually greater than body depth in *H. clupeola* but usually less than body depth in *H. pensacolae*. The range of the two species is almost identical, from Brazil to the West Indies, and northwards to Florida Keys (*H. clupeola*) or New Jersey (*H. pensacolae-fide* Fowler, 1945).

Of the Valenciennes material, the four Brazil fishes agree with both *H. clupeola* and *H. pensacolae* in gillraker count, but are closer to *H. pensacolae* in their deeper bodies, shorter snouts, slightly shorter upper jaws and the fact that the distance

dorsal origin to eye centre is noticeably less than body depth. The three St. Domingo fishes, on the other hand, while having an even higher gillraker count, in one case (35) outside the range of *H. clupeiola* (28–34), are noticeably more slender, as Valenciennes comments, although still just within the range for body depth of *H. pensacolata* cited by Rivas. The distance dorsal origin–eye centre is very slightly more than body depth.

In spite of the very useful revisions of Storey (1938) and Rivas (1950), there is evidently much more work needed on the species *H. clupeiola* and *H. pensacolata*, particularly on the range of variation in each and the limits of the five subspecies of *H. pensacolata* recognized by Rivas. For the present, the Valenciennes material of *H. humeralis* cannot be unequivocally assigned to either one or other species, but in most characters it tends towards *H. pensacolata* and is identified as such here. Berry (1964c) has commented on the similarities of the two species and on the fact that in the illustration given by Rivas (1964) it is *H. pensacolata* and not *H. clupeiola*, that has the more slender body.

HERKLOTSICHTHYS Whitley, 1951

Herklotsichthys Whitley, 1951, *Proc. Roy. zool. Soc. N.S.W.*, 1949–50 : 67 (Type : *Harengula dispilonotus* Bleeker).

The Valenciennes material contains only a single species of *Herklotsichthys*, the widespread *H. punctatus* (Rüppell). Through a series of errors and misinterpretations, a second widespread species, *Herklotsichthys vittatus* (Valenciennes) has until now been recognized by authors (Regan, 1917b and Fowler, 1941 for example), although its approach to *Sardinella* in shape of 2nd supra-maxilla and numbers of fronto-parietal striae has been noted (Whitehead, 1965b). Re-examination of the Valenciennes material and British Museum specimens has convinced me that this second species must be placed in *Sardinella*, not *Herklotsichthys*. This is discussed under *Clupeonia vittata* (p. 66).

13. *Sardinella lineolata* Valenciennes, 1847 = *Herklotsichthys punctatus* (Rüppell, 1837)

Clupea punctata Rüppell, 1837, *Neue Wirbelth., Fische* : 78, pl. 21, fig. 2 (Red Sea).

Sardinella lineolata Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 272 (Trincomalee and Bourou I ; some small individuals, 4 inches, and one fish 5 inches ; Regnault, and Lesson & Garnot).

TYPE MATERIAL. MNHN. 666, 2 fishes, 75.4–82.7 mm. S.L., ex Trincomalee, coll. Regnault (1829).

MNHN. 3106, 1 fish, 104.2 mm. S.L., ex Mollucas, coll. Lesson & Garnot (1825).

The largest of the Trincomalee fishes is chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 82.7 mm. S.L., ex Trincomalee (Ceylon), coll. Regnault, in good condition except for loss of scales, MNHN. 666.

Br.St. 6, D v 15 (1st unbranched minute), P i 15, V i 7, A iii 16, g.r. 32, scutes 18 + 12, scales (indet.).

In percentages of standard length : body depth 25.6, head length 29.2 ; snout length 8.3, eye diameter 9.8, length of upper jaw 14.5, length of lower jaw 14.0 ; pectoral fin length 19.9, pelvic fin length 13.1, length of anal base 14.4 ; pre-dorsal distance 48.7, pre-pelvic distance 55.0, pre-anal distance 78.0.

Body compressed, belly fairly sharply keeled, body depth less than head length. Maxilla with fine denticulations on lower border below expanded portion of 2nd (posterior) supra-maxilla, the latter with lower part larger than upper ; anterior supra-maxilla present, slender ; no hypo-maxillae. A few small conical teeth present on dentary symphysis.

Pseudobranch present, exposed, $\frac{1}{2}$ eye diameter in length. Gillrakers fine, slender, $1\frac{1}{3}$ times length of corresponding gill filaments, $\frac{1}{2}$ eye diameter. Fronto-parietal region with a cuneiform area on each side bearing 3-4 longitudinal striae. Posterior border of gill opening with a bilobed dermal appendage on the vertical face of cleithrum, and a well-developed cleithral lobe.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{2}{3}$ eye diameter. Pectoral fin tips failing to reach pelvic base by $\frac{2}{3}$ eye diameter. Pelvic base below 4th branched dorsal ray, nearer to anal origin than to pectoral base by $\frac{1}{3}$ eye diameter. Anal origin slightly nearer to pelvic base than to caudal base ; last two anal rays not markedly enlarged.

COLOUR : upper $\frac{1}{3}$ of body grey-green, remainder of flanks silvery ; fins hyaline.

Note. Valenciennes stated that the Lesson & Garnot specimen differed from the two Trincomalee fishes only in having a smaller eye ; measurements of the syntypes confirms this (6.7 per cent of S.L., cf 9.2-9.8 per cent in the Trincomalee specimens). The gillraker counts and scute counts are similar in all three specimens (respectively 32, 32, 34 and 18 + 12, 17 + 13, 17 + 14).

Valenciennes noticed that his *Sardinella lineolata* differed from all his other species of *Sardinella* in lacking the characteristic striations on the posterior part of the head. It is, in fact, the rather fewer fronto-parietal striae in species of *Herklotsichthys* which is nowadays an important character separating this genus from *Sardinella* (Whitehead, 1964a, c, fig. 1).

14. *Harengula bipunctata* Valenciennes, 1847
= *Herklotsichthys punctatus* (Rüppell, 1837)

Harengula bipunctata Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 298 (on MS. descr. of *Clupea bipunctata* by Ehrenberg, ex Massawa, Red Sea).

Valenciennes based his description on the MS. name and notes supplied by Ehrenberg. There is nothing in Valenciennes' description which would distinguish this species from a member of *Sardinella*, but the "deux taches jaunes" on the operculum recall the single orange mark at the postero-dorsal angle of the operculum in Red Sea *Herklotsichthys punctatus* (personal observation on specimens preserved in brine ; see below, p. 36). The meristic counts given by Valenciennes are typical of most members of *Herklotsichthys* and *Sardinella*.

Of the five species of *Sardinella* known from the Red Sea (Whitehead, 1965b), *S. longiceps* and *S. sirm* are too slender, while *S. bulan*, *S. gibbosa* and *S. fimbriata* have

not been recorded from the South Red Sea. *Herklotsichthys vittatus* (i.e. *Sarinellida melanura*) is known from Massawa itself (Whitehead, *loc. cit.*), but its dark caudal tips could not have escaped notice. *Herklotsichthys punctatus*, on the other hand, not only agrees with the description but is one of the commonest fishes in the Massawa area (Whitehead, 1966d).

15. *Harengula arabica* Valenciennes, 1847
= *Herklotsichthys punctatus* (Rüppell, 1837)

Harengula arabica Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 298 (on MS. descr. of *Clupea arabica* by Ehrenberg, *ex* Mohila, Red Sea).

Valenciennes was even more doubtful about placing this species in *Harengula* than in the case of Ehrenberg's *Clupea bipunctata*. Once again, the description is quite inadequate, but in this case Valenciennes describes a gold and orange longitudinal band separating the blue of the back from the silver of the flanks. Such a band is present in Red Sea *Herklotsichthys punctatus*, and in the absence of any evidence to the contrary, this Valenciennes name is also placed in the synonymy of *H. punctatus*.

16. *Clupeonia fasciata* Valenciennes, 1847
= *Herklotsichthys punctatus* (Rüppell, 1837)

Clupeonia fasciata Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 349 (Saint-Denis de Bourbon ; one fish, 6 inches ; Leschenault).

TYPE MATERIAL. MNHN. 895, 1 fish, 127.4 mm. S.L., *ex* Reunion, coll. Leschenault (1818).

DESCRIPTION. *Holotype*, a fish of 127.4 mm. S.L., *ex* St. Denis, Reunion I., coll. Leschenault (1818), in good condition but some scales shed, MNHN. 895.

Br.St. (n.r.), D iv 15, P i 14, V i 7, A ii 14, g.r. 32, scutes 18 + 13, scales (indet.).

In percentages of standard length : body depth 26.2, head length 26.0 ; snout length 7.4, eye diameter 7.4, length of upper jaw 11.4, length of lower jaw 11.5 ; pectoral fin length 17.2, pelvic fin length 12.3, length of anal base 12.5 ; pre-dorsal distance 46.7, pre-pelvic distance 52.3, pre-anal distance 80.5.

Body moderately compressed, belly moderately keeled, body depth equal to head length. Snout length equal to eye diameter. Maxilla with slightly denticulated lower border ; two supra-maxillae present, the posterior with lower part of expanded portion larger than upper ; no hypo-maxillae. A few fine teeth on dentary symphysis ; a single series on tongue.

Pseudobranch present, exposed, its length $\frac{7}{8}$ of eye diameter. Gillrakers fine, slender, equal in length to corresponding gill filaments, equal to $\frac{1}{2}$ eye diameter. Fronto-parietal region with paired cuneiform areas bearing 4-5 longitudinal striae.

Scales with a single heavy and 3-4 fainter uninterrupted vertical striae ; posterior margins of scales showing very faint signs of erosion but no perforations, striae or ridges on exposed portion.

COLOUR. Upper $\frac{1}{3}$ of body light grey-brown, rest of flank silver, the two areas separated by a thin light band with a thin dark brown band below it (mentioned by Valenciennes as "une bandalette longitudinale noirâtre").

IDENTIFICATION. This specimen agrees well with the description of the type of *Clupea punctatus* Rüppell and other Red Sea material (Whitehead, 1965b). Valenciennes gives the anal count as "A.8", but this is obviously an error.

Valenciennes believed *Clupeonia fasciata* to be close to his *Clupeonia jussieui* (near *Sardinella dayi* Regan of authors, see p. 60), differing mainly in having a more elongate body, longer head, more obtuse snout and larger eye. Also, he notes that "L'opercule n'a point de stries sur toute sa surface" contrasting this with the "stries rayonnantes, fine et nombreuses" in *C. jussieui*. In fact, a striated operculum is never found in either *Herklotsichthys* or *Sardinella*, and Valenciennes may have mistaken the cutaneous canals for striae.

Chabanaud (1926) used tooth characters to distinguish the genera *Sardinella*, *Clupeonia* and *Amblygaster*; the three are nowadays combined but are clearly distinguished from *Herklotsichthys*. He placed the type of *Clupeonia fasciata* in the genus *Clupeonia* and thus continued the errors of Valenciennes' classification on dentition. Fowler (1941: 612) took Chabanaud's word for it, and believed *Clupeonia fasciata* Valenciennes to be identical with *Sardinella jussieu*. *Clupeonia fasciata* pre-dates Bleeker's *Sardinella gibbosa*, and was thus thought the most likely alternative should the poorly described *Clupanodon jussieu* Lacepède prove to be a *nomen dubium* (Whitehead, 1965b). Many authors had hitherto followed Regan (1917b) in citing the species as *Sardinella gibbosa* Bleeker.

Chabanaud (1926: 158) was also incorrect in re-defining the genus *Clupeonia* on the basis of the types of *C. fasciata*. He argued that the genus was based on the poorly described *Clupanodon jussieu* of Lacepède, which lacks a type specimen. In fact, the diagnosis of *Clupeonia* is clearly derived from Valenciennes' specimens of *Clupeonia jussieui*, a member of *Sardinella* but a very different species from Lacepède's. Thus *Clupeonia* must remain in the genus *Sardinella* and is available as a subgenus should this be required.

17. *Meletta obtusirostris* Valenciennes, 1847
= *Herklotsichthys punctatus* (Rüppell, 1837)

Meletta obtusirostris Valenciennes, 1847, *Hist. Nat. Poiss.*, 20: 375 (Seychelles; numerous specimens, 6 inches; Dussumier).

TYPE MATERIAL. MNHN. 900, 11 fishes, 85.4–115.2 mm. S.L., ex Seychelle Is., coll. Dussumier.

The largest of these syntypes is here selected as lectotype.

DESCRIPTION. *Lectotype*, a fish of 115.2 mm. S.L., ex Seychelles, coll. Dussumier, in fair condition, caudal tips undamaged, belly slit, scales mostly shed, MNHN. 900.

Br.St. 6, D iv 15 (1st ray minute), P i 14, V i 7, A iii 13, g.r. 33, scutes 18 + 11, scales (indet.).

In percentages of standard length: body depth 26.7, head length 28.0; snout length 7.9, eye diameter 8.5, length of upper jaw 12.9, length of lower jaw 13.3; pectoral fin length 20.2, pelvic fin length 11.7, length of anal base 13.9; pre-dorsal distance 48.5, pre-pelvic distance 53.9, pre-anal distance 78.1.

Body moderately compressed, belly moderately keeled, body depth a little less than head length. Snout a little shorter than eye diameter. Two supra-maxillae, the 2nd (posterior) with lower part of expanded portion larger than upper; no hypo-maxillae.

Pseudobranch present, exposed, its length $\frac{4}{5}$ of eye diameter. Gillrakers fine, slender, equal in length to corresponding gill filaments, $\frac{1}{2}$ eye diameter. Fronto-parietal region with paired cuneiform wedges bearing 5 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral fin tips failing to reach pelvic base by 1 eye diameter. Pelvic fin base below 6th branched dorsal ray, nearer to anal origin than to pectoral base by $\frac{1}{3}$ eye diameter; axillary scale present, almost as long as fin. Anal origin equidistant between pelvic base and caudal base; last ray slightly enlarged.

Scales with one large and 3-4 finer vertical uninterrupted striae (as Valenciennes noted).

COLOUR: upper $\frac{1}{4}$ of body slate/brown, remainder of flanks silver; fins hyaline.

Note. Having once more been misled by tooth characters, Valenciennes placed this species in *Meletta* and was immediately struck by the large blunt head, a feature that would have appeared normal had he placed this fish amongst his species of *Harengula*. Regan (1917b), Bertin (1940) and Fowler (1941) all agreed in identifying *M. obtusirostris* as *Harengula punctata*.

18. *Meletta venenosa* Valenciennes, 1847
= *Herklotsichthys punctatus* (Rüppell, 1837)

Meletta venenosa Valenciennes, 1847, *Hist. Nat. Poiss.*, **20**: 377 (Seychelles; no number, 5 inches; Dussumier).

SPECIMENS. MNHN. 92, 149-150, 2 fishes, 91.1-96.3 mm. S.L., ex Seychelles, coll. Alluaud (labelled "*Clupea venosa*").

The original Dussumier specimens are not in the museum and were not recorded by Bertin (1940). A description is given here of the Alluaud specimens since they are from the type locality. Should the necessity ever arise, these would be available for neotype selection.

DESCRIPTION. Two fishes, 91.1 and 96.3 mm. S.L., ex Seychelle Is., coll. Alluaud, MNHN. 92, 149-150 (figures for larger fish given first).

Br.St. 7, D iv 15 (both), P i 14-15, V i 7 (both), A iii 15 and 14 (1st ray minute in larger fish), g.r. 16 + 34 and 16 + 34, scutes 17 + 12 and 18 + 12, scales 37 or 38.

In percentages of standard length: body depth 27.5, 26.5, head length 27.8, 28.7; snout length 7.9, 8.1, eye diameter 9.1, 8.4, length of upper jaw 13.2, 12.9, length of lower jaw 12.8, 13.2; pectoral fin length 19.1, 16.8, pelvic fin length 13.7, 13.2, length of anal base 13.6, 13.7; pre-dorsal distance 46.2, 48.6, pre-pelvic distance 55.6, 56.4, pre-anal distance 79.8, 81.5.

Body moderately compressed, belly rounded and little keeled, its depth a little less than head length, its width $2\frac{3}{4}$ times in depth. Snout a little shorter than eye

diameter. Maxilla reaching to vertical from anterior pupil border, with fine denticulations along central $\frac{1}{3}$ of lower edge ; two supra-maxillae, the 2nd (posterior) with lower part of expanded portion larger than upper ; anterior supra-maxilla small, plate-like ; no hypo-maxillae. About 8 small teeth on dentary symphysis.

Pseudobranch present, exposed, its length $\frac{4}{5}$ of eye diameter. Gillrakers fine, slender, equal in length to corresponding gill filaments, about $\frac{1}{2}$ eye diameter ; small gillrakers present on posterior face of 3rd epibranchial ; mediopharyngo-branchial present, with 3-4 gillrakers on each side. Fronto-parietal region with paired cuneiform wedges bearing 3-4 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral fin tips failing to reach pelvic base by just less than 1 eye diameter ; no axillary scale present, but distinct groove capable of receiving first pectoral ray. Pelvic base below 6th branched dorsal ray, slightly nearer to anal origin than to pectoral base ; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{4}$ eye diameter.

Scales with 1 main and 2-6 smaller uninterrupted vertical striae.

COLOUR : upper $\frac{1}{4}$ of body bluish slate, remainder of flank silver, or gold where scale cover retained, the two areas separated by a thin silver band with a thin black line below it. Small crescent of pigment missing from postero-dorsal angle of operculum, giving appearance of a black spot. Fins hyaline except for black of tips of anterior dorsal rays and a slight duskiness of caudal.

IDENTIFICATION. These two specimens agree well with descriptions of Red Sea *Herklotsichthys punctatus* (Whitehead, 1965 b). A recent study of East African material has shown, however, that two fairly distinct colour forms exist in that area (Losse, in press). In life, Form A has an orange midlateral line and dark pigmentation on the anterior dorsal rays. Form B has an electric blue midlateral line, with a distinct darker line below it, and the dorsal fin is plain. The midlateral line fades in preserved material, but the dorsal pigmentation (Form A) and the narrow dark line (Form B) remain. Both of the latter are present in the specimens described here. On colour (but not on depth), Losse identified his Form A with the rather more slender *H. punctatus* of the Red Sea, and the characteristic orange markings are certainly present in brine preserved material from that area. The specimens described here suggest that in the Seychelles the two colour forms are perhaps not so distinct as they are along the African coast.

SARDINELLA Valenciennes, 1847

Sardinella Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 261 (Type : *Sardinella aurita* Valenciennes, designated by Gill, 1861, *Proc. Acad. nat. Sci. Philad.* : 35).

This genus was erected by Valenciennes almost entirely on its dental formula, i.e. teeth present on palatines, pterygoids and tongue, but absent in jaws and on vomer. Valenciennes deplored the lack of such details in the descriptions of earlier authors (Brunnich, Risso, Rafinesque, Cocco and Swainson), saying that they did not take into account "des excellents caractères que j'ai tirés de la dentition . . .". As the present work shows, an unjustified reliance on dentition led Valenciennes to distribute

nine true species of *Sardinella* amongst six genera, separating juveniles or even adults of the same species in different genera. Only one of the species included by him in *Sardinella* (i.e. *S. lineolata*), however, does not belong in this genus, but in *Herklotsichthys*.

There is still urgent need for revision in this genus, particularly of the more widely distributed species or species complexes. The results of the present study, while incomplete in themselves, will materially aid such a revision by removing the purely nomenclatural tangle that confused so many names. The following summary can be given.

1. *Clupanodon jussieu* Lacepède is considered a *nomen dubium*; it should be replaced by *Sardinella gibbosa* (Bleeker).
2. *Harengula vittata* Val. is *Sardinella melanura* (Cuvier); there is no *Herklotsichthys* species with black caudal tips.
3. *Sardinella melanura* (Cuvier, 1829) has the following synonyms
Clupeonia commersoni Val.
Clupea otaitensis Val.
Clupeonia vittata Val.
Alausa melanura Val.
4. *Clupeonia jussieui* Val. is not the same as *Clupanodon jussieu* Lacepède nor *Clupea gibbosa* Bleeker. It is a distinct species resembling both *Sardinella dayi* Regan and *S. maderensis* (Lowe) in having a high gillraker count, but it is distinct from both.

The species of *Sardinella* have been identified mainly using the keys given by Chan (1965) and Whitehead, *et alii* (1966).

19. ***Sardinella aurita*** Valenciennes, 1847

= ***Sardinella aurita*** Valenciennes, 1847

? *Clupea allecia* Rafinesque, 1810, *Caratteri nuovi animali piante Sicilia*: 57 (ex Sicily; identity uncertain).

Clupea aurovittata Swainson, 1838, *Nat. Hist. Anim.*, 1: 265, fig. 56 (no descr.); *Idem*, 1839, *Nat. Hist. Anim.*, 2: (293), 385 (ex Palermo; *nomen oblitum*).

Clupea caeruleovittata Richardson, 1846, *Ichthyol. China Japan*: 305 (China Seas; *nomen oblitum*).

Sardinella aurita Valenciennes, 1847, *Hist. Nat. Poiss.*, 20: 263, pl. 594 (Messina; many fishes, to 11 inches; Bibron).

[for notes on this synonymy, see below]

TYPE MATERIAL. MNHN. 663, 2 fishes, 207.0–231.0 mm. S.L., ex Messina, coll. Bibron.

MNHN. A.9824, 2 fishes, 166.0–194.5 mm. S.L., ex Messina, coll. Bibron.

Bertin (1940) combined these two lots, with an acquisition date of 1824–1829. The smaller of the two fishes in MNHN. A.9824 is chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 166.0 mm. S.L., ex Messina, coll. Bibron, in rather poor condition, belly and pectoral tips damaged, most scales gone, lower jaw cut at symphysis, lower part of 1st gill arch on right side missing, MNHN. A.9824.

Br.St. 6, D iv 15, P i 16, V i 8, A iii 15, g.r. 127 (left), scutes 9 (+ 2?) 9 + 15, vertebrae 49 (both fishes, from radiograph).

In percentages of standard length : body depth 22.2, body width 10.8, head length 25.3 ; snout length 7.4, eye diameter 6.5, length of upper jaw 9.8, length of lower jaw 11.5, vertical depth of cheek (including articulation of lower jaw) 6.2 ; pectoral fin length (damaged), pelvic fin length 8.1, length of anal fin base 14.1 ; pre-dorsal distance 44.0, pre-pelvic distance 50.6, pre-anal distance 75.4.

Body only a little compressed, its width twice in depth, belly rounded and little keeled, body depth less than head length. Snout longer than eye diameter. Two supra-maxillae present, the 2nd (posterior) with upper and lower portions of expanded part unequal, the lower part larger (Figure 1a) ; no hypo-maxillae. Maxilla reaching to vertical from anterior pupil border.

Pseudobranch present, exposed, equal to eye diameter and with ventral margin forming a distinct ridge with a groove below, the latter apparently receiving the tips of the lower rakers of the 1st arch. Gillrakers long and slender, about equal to longest gill filaments, $\frac{3}{4}$ eye diameter. Fronto-parietal region with paired cuneiform areas bearing 8-9 longitudinal striae, the striated areas not meeting in midline.

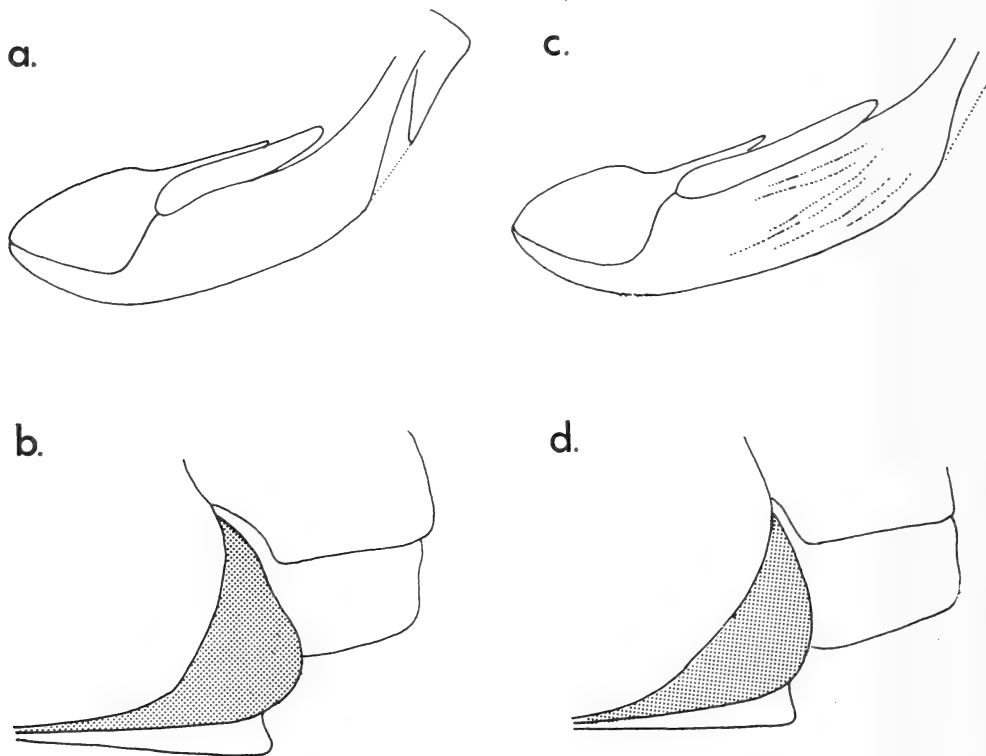


FIG. 1. Upper jaw bones and shape of interoperculum (stippled) in species of *Sardinella*.
 a. *S. aurita* lectotype, 166 mm. S.L. (MNHN. A.9824). b. *S. longiceps* lectotype, 124.5 mm. S.L. (MNHN. 3743). c. *S. anchovia* lectotype, 117.5 mm. S.L. (MNHN. 3746).
 d. *S. neohowii* lectotype (= *S. longiceps*), 123.0 mm. S.L. (MNHN. 3744).

Dorsal fin origin nearer to snout tip than to caudal base by 2 eye diameters. Pectoral fin tips failing to reach pelvic base by $1\frac{1}{2}$ eye diameters (estimated). Pelvic base below 8th branched dorsal ray, nearer to pectoral base than to anal origin by 1 pupil diameter; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin nearer to caudal than to pelvic base by $\frac{1}{3}$ eye diameter.

Scales with one large and 4-5 finer vertical striae, the latter interrupted in centre of scale; posterior border of scale not eroded or perforated. Alar scales present.

COLOUR: upper $\frac{1}{3}$ slate-grey, remainder of flanks silver, or golden where scale cover retained. A small semi-circle at upper angle of operculum appears black due to absence of internal layer of guanine. (Caudal tips black in paralectotype, 207.0 mm. S.L., MNHN. 663).

IDENTIFICATION. Regan (1917b) and subsequent authors have recognized this species as the most widespread of all the *Sardinella* species, recording it from the tropical Atlantic, the Mediterranean and the western part of the Pacific; it is apparently replaced by *S. longiceps* in the Indian Ocean. American workers (see p. 43) have claimed the western Atlantic *Sardinella* to comprise one or more distinct species, but there has been no recent attempt to separate the West African and Pacific *S. aurita* from that of the Mediterranean.

The following measurements were made on two paralectotypes.

Paralectotypes, 2 fishes 207 and 231 mm. S.L., ex Messina, coll. Bibron, both with damaged 1st gill arches, MNHN. 663. Measurements for smaller fish in parentheses.

Br.St. 6, D v 14 (iv 15), P i 16 (i 16), V i 8 (i 8), A iii 15 (iii 15), g.r. (indet.), scutes 19 + 15 (7 . . . 11 + 15).

In percentages of standard length: body depth 22.8 (21.2), head length 22.7 (24.0); snout length 6.6 (6.7), eye diameter 5.4 (5.8), upper jaw 9.0 (9.2), lower jaw 10.5 (11.2); pectoral fin length 15.8 (15.4), pelvic fin length 8.2 (8.2), length of anal fin base 12.6 (13.2); pre-dorsal distance 44.8 (43.6), pre-pelvic distance 48.8 (51.0), pre-anal distance 78.5 (76.5).

Note. Fowler (1941: 602) listed four names prior to *Sardinella aurita* Valenciennes. The first of these is *Clupea allecia* Rafinesque, 1810. Unfortunately, Rafinesque (1810: 57) mentions only four characters in his description,

colour: typical of many clupeids, i.e. silvery, reflecting blue-green, etc.

size: a little larger than the herring, about 1 foot.

dorsal: 10 rays—surely an error, too low for *Clupea*, *Sardinella* and *Alosa*.

anal: about 18 rays, which could fit any of the above genera.

Rafinesque could thus have been referring to *Sardinella aurita*, *S. maderensis*, or even to *Alosa alosa* or *Alosa fallax*, although the black humeral spot in the last two (and the series of spots along the flank in *A. fallax*) tend to eliminate *Alosa*. Rafinesque cited the Sicilian vernacular name as *Allecia* or *Alaccie*, which is fairly close to modern vernacular names for the shads, such as *alosa*, *alose*, *alice*, etc. On the other hand, Palombi & Santarelli (1961) cite the common Sicilian names *allecia*, *lacciuna* and *sarda* for *Sardinella aurita*. *Sardina pilchardus* (Walbaum) can be eliminated since it only attains 180 mm. (8 inches) and the black spots along the flanks would surely have been mentioned. At present, therefore, the Rafinesque

name can only be tentatively identified with *Sardinella aurita*, with *S. maderensis* an equal possibility. The use of the name *allecia* by Fowler (1941) prevents its suppression as a *nomen oblitum*, but its use would seriously affect stability in the nomenclature of such a well-known and commercially important species; application will, therefore, be made to the International Commission to suppress this name. (The question of the validity of the name *allecia* raises an important point concerning Art. 23 (b) of the International Code. Was Fowler's use of *allecia* correct since prior to this it had not been used for 50 years? There is no indication in Art. 23 (b) that it should or should not act in retrospect, and Smith (1964) has pointed out this and other absurdities in the formulation of Art. 23 (b) as it stands at present.)

The second synonym listed by Fowler (*loc. cit.*) is *Engraulis desmaresti* Risso. Risso (1826) gave a recognizable diagnosis of *Engraulis*, followed by a fair description of *E. encrasicolus* Linnaeus. His next species, *E. desmaresti* contradicts the generic diagnosis by having no teeth in the jaws, a blunt snout, no mention of the long maxilla, and the belly *caréné*. The pelvic count of 8 immediately rules out *Sardinella aurita* (always 9). The true identity of this fish is difficult to determine. The figure (Risso, *loc. cit.* plate 9, fig. 22) shows a very slender clupeid (body depth 19.2 per cent. of standard length), closely resembling *Engraulis encrasicolus* except for its clupeid and not engraulid jaws. Six transverse blue bars extend down to the middle of the flank. The general impression of the drawing is that it was built up mainly from a description and not from an actual specimen. Since the pelvic count eliminates *Sardinella aurita*, there is no urgency about this identification. The name has not been used as a senior synonym for 50 years and the Mediterranean clupeid fauna is sufficiently well known that *Engraulis desmaresti* will be found to apply almost certainly to a known species. Dr Blanc informs me that the type of *E. desmaresti* is not in Paris. There is thus good reason to suppress it as a *nomen dubium* since it can only become an awkward synonym and a *nomen oblitum* once it is identified with certainty.

The third name cited by Fowler (1941) as a senior synonym of *Sardinella aurita* is *Clupea aurovittata* Swainson, 1838. The absence of jaw teeth and the enlarged final two anal rays indicate *Sardinella*, and the pelvic count of 9 is diagnostic of *S. aurita*. The type locality, Palmero, rules out *Clupea harengus*. The figure (1838) and excellent description (1839) fully accord with *S. aurita*. It is curious that this Swainson name has apparently been ignored for so long. It was not mentioned by Regan (1917b), nor by Svetovidov (1963) or Bănărescu (1964). The name is clearly a *nomen oblitum* and application will be made to the International Commission to suppress it in favour of the widely used name *aurita*.

The final name cited by Fowler (1941) is *Clupea caeruleovittata* Richardson. Elsewhere (Whitehead, 1966a : 28) I suggested that this might perhaps refer to *Sardinella leiogaster* Valenciennes, since Richardson (1846) had already listed *Sardinella aurita* under the name *Clupea nymphaea* Rich. But subsequently Mr. W. Chan has informed me that Wong-tsark, the Chinese equivalent for *C. caeruleovittata* cited by Richardson, applies *only* to *Sardinella aurita*. Application has been made to the International Commission (Whitehead, 1966b) to suppress the name *caeruleovittata*.

For the present, therefore, the name *Sardinella aurita* should be used for this species until the Commission has voted on the validity of these earlier synonyms.

20. *Meletta mediterranea* Valenciennes, 1847

= *Sardinella aurita* Valenciennes, 1847

Meletta mediterranea Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 369 (Toulon, Marseille ; some fishes, no sizes ; Banon, Roux).

TYPE MATERIAL. MNHN. 3745, 2 fishes, 62.1–67.3 mm. S.L., ex Toulon, coll. Banon (1827). Both in poor condition.

The largest of these is selected as lectotype and the smaller as paralectotype. The Roux fishes from Marseille are not now present and were not listed by Bertin (1940).

DESCRIPTION. *Lectotype*, a fish of 67.3 mm. S.L., ex Toulon, coll. Banon, in poor condition, pectoral tips damaged, last six post-pelvic scutes present but displaced, about four final dorsal rays missing, most scales shed, MNHN. 3745.

Br.St. (n.r.), D iv 9 (? + 4 more), P i 15, V i 8, A iii 14 or ii 15, g.r. 83, scutes 19 + 15, scales (indet.).

In percentages of standard length : body depth 21.6, head length 27.1 ; snout length 7.4, eye diameter 7.3, length of upper jaw 11.0, length of lower jaw 12.9 ; pectoral fin length 13.9 (tip damaged), pelvic fin length 9.4, length of anal fin base 14.1 ; pre-dorsal distance 45.9, pre-pelvic distance 51.9, pre-anal distance 78.5.

Body a little compressed, belly not strongly keeled, body depth less than head length. Snout about equal to eye diameter. Maxilla with fine denticulations along lower border for a short distance below 2nd supra-maxilla ; two supra-maxillae, the 2nd (posterior) with lower portion of expanded part deeper than upper, in general shape as in adult *S. aurita* (Figure 1a) ; no teeth on pre-maxillae but a few minute teeth at dentary symphysis.

Pseudobranch present, exposed, almost equal to eye diameter, its lower edge ridged, with a distinct groove below. Gillrakers fine and slender, $1\frac{1}{2}$ times as long as corresponding gill filaments, about $\frac{1}{2}$ eye diameter ; a long mediopharyngo-branchial bearing many gillrakers. Fronto-parietal region with paired cuneiform areas bearing 7 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{1}{2}$ eye diameters. Pelvic base equidistant between pectoral base and anal origin, lying below vertical from 7th branched dorsal ray. Anal origin nearer to caudal base than to pelvic base by 1 pupil diameter ; last two anal rays enlarged.

Scales with neither eroded nor fimbriated posterior borders ; unexposed portion with one large and three finer vertical striae, the latter interrupted at the centre of the scale.

COLOUR : upper $\frac{1}{3}$ of body slate grey, remainder of flanks silver ; fins hyaline.

IDENTIFICATION. The pelvic count of i 8 is diagnostic for *Sardinella aurita* in the Mediterranean ; the form of the pseudobranch and 2nd supra-maxilla are also typical of *S. aurita*.

Valenciennes' classification on dentition once again led him to separate adults and juveniles of the same species, placing them in different genera.

21. *Sardinella anchovia* Valenciennes, 1847
 = *Sardinella aurita* Valenciennes, 1847

Sardinella anchovia Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 269 (Rio de Janeiro and Martinique ; some fishes, to $7\frac{1}{2}$ inches ; Delalande, Gay, d'Orbigny and Plée).

TYPE MATERIAL. MNHN. 3746, 1 fish, 117.5 mm. S.L., ex Rio de Janeiro, coll. Delalande.

MNHN. 3380, 1 fish, 143.6 mm. S.L., ex Rio de Janeiro, coll. Gay (1832).

MNHN. 5484, 2 fishes, 104.5–108.0 mm. S.L., ex Rio de Janeiro, coll. d'Orbigny.

MNHN. 3747, 1 fish, 84.5 mm. S.L., ex Martinique, coll. Plée (shrivelled).

From these, the specimen from MNHN. 3746 was chosen as lectotype by Longley & Hildebrand (1941). They considered the remainder to belong to the closely related *Sardinella brasiliensis* (Steindachner)—see discussion below.

DESCRIPTION. *Lectotype*, a fish of 117.5 mm. S.L., ex Rio de Janeiro, coll. Delalande, body a little damaged, with vertical splits in flanks above pectoral and behind pelvic tips on left side, and diagonal split above anal base on right side, caudal tips broken, scales missing anteriorly, MNHN. 3746.

Br.St. 6, D iii 14, P i 15 (right i 16), V i 8, A iii 14, g.r. 100, scutes 1 (? 4 lost) 15 + 15.

In percentages of standard length : body depth 19.5, body width 10.5, head length 25.8 ; snout length 7.6, eye diameter 5.6, length of upper jaw 9.8, length of lower jaw 12.1 ; pectoral fin length 16.2, pelvic fin length 9.1, length of anal base 14.8 ; pre-dorsal distance 43.3, pre-pelvic distance 51.0, pre-anal distance 72.3.

Body cylindrical, its width 1.8 times in its depth, belly rounded, scutes not strongly keeled. Head length much greater than body depth. Snout longer than eye diameter. Upper jaw reaching to vertical from anterior border of eye ; maxilla smooth along lower edge except for a few very fine denticulations below 2nd supra-maxilla ; two supra-maxillae present (Figure 1c), the 1st (anterior) about 5 times as long as deep, the 2nd (posterior) with lower part of expanded portion much larger than upper, upper and lower profiles meeting the base of the anterior shaft at the same point ; expanded portion of maxilla with 4 or 5 longitudinal striae below 1st supra-maxilla.

Operculum rectangular, with almost horizontal lower edge ; sub-operculum rectangular. Fronto-parietal region with a pair of cuneiform areas bearing 8 longitudinal striae, these two areas not meeting in the midline posteriorly. Supra-orbitals with a prominent ridge along inner edge and 3 short longitudinal striae on posterior $\frac{1}{4}$ of bone. Vertical depth of cheek 6.0 per cent of S.L.

Pseudobranch present, exposed, just over 1 eye diameter in length, with well defined ventral ridge and groove below it. Gillrakers long, slender, $1\frac{1}{3}$ times length of gill filaments, $\frac{3}{4}$ eye diameter ; epibranchial gillrakers on 1st arch folding upwards slightly ; gillrakers present on posterior face of 3rd epibranchial, about 65, plate-like and short ; mediopharyngobranchial present, carrying about 30 gillrakers.

Dorsal fin origin nearer to snout tip than to caudal base by 2 eye diameters. Pectoral fin tips failing to reach vertical from dorsal origin by $\frac{1}{2}$ eye diameter ; failing to reach pelvic base by $1\frac{3}{4}$ eye diameters. Pelvic base below 9th branched dorsal

ray, equidistant between pectoral base and anal origin. The latter nearer to caudal base than to pelvic base by $\frac{1}{3}$ eye diameter.

Scales (below posterior dorsal base) with one complete and 2-3 incomplete vertical striae ; alar scales present.

COLOUR : upper $\frac{1}{8}$ of body dark grey-blue, remainder of flanks silvery. A semi-circular unpigmented area on hind border of operculum, giving the appearance of a black spot.

IDENTIFICATION. Most authors have followed Regan (1917b) and placed *Sardinella anchovia* in the synonymy of *S. aurita*, thus recognizing a wide-spread species extending from China to the western North Atlantic. Longley & Hildebrand (1941) and later Hildebrand (1964) disagreed, finding the following differences after examining the types in Paris :

1. *S. aurita* grows larger than any American *Sardinella*.
2. Body more slender in *S. aurita* than in *S. anchovia* at equivalent sizes.
3. Pectoral fin shorter in *S. aurita*.
4. More scutes in *S. aurita*.

The measurements given here for the types add nothing to this, and Hildebrand (1964) quite rightly considered that the true solution must await much more extensive comparative material. There is, as yet, no single study on variation in *S. aurita* over its immense Mediterranean and Pacific range. Some preliminary work by Ben-Tuvia (1963, 1964) on the influence of temperature on vertebral counts suggests that meristic differences may prove deceptive. Elsewhere (Ben-Tuvia, 1959), this author showed so great an overlap in body depth in specimens of *Sardinella maderensis*, *S. eba* and *S. granigera* that he united the three (see below p. 48). Thus Longley's conclusions should be treated with caution, and no positive conclusions can be drawn from an examination of merely the types.

Longley & Hildebrand (1941) also noted that the specimen of *Sardinella anchovia* that they designated as lectotype (MNHN. 3746) had only 105 gillrakers while the Gay and d'Orbigny specimens had 160-178. My own counts (right arch only) for these fishes are :

MNHN. 3380	143.6 mm.	S.L. 179	
MNHN. 5484	104.5 mm.	S.L. 151	} arches damaged slightly
	108.0 mm.	S.L. 174	
MNHN. 3746	117.5 mm.	S.L. 100	(lectotype)

In the first three fishes the gillrakers are much finer and more closely set than in the lectotype. They are also $1\frac{1}{4}$ times the length of the longest gill filaments and equal to eye diameter (cf. $\frac{3}{4}$ eye diameter in lectotypes of *S. anchovia* and *S. aurita*, and equal to gill filaments in lectotype of *S. aurita*). Hildebrand (1964) followed Longley in equating these three fishes with *Sardinella brasiliensis* (Steindachner, 1879). Certainly there is a difference in the appearance of the head. In the three "*brasiliensis*" specimens the cheek is deeper than in the lectotype of "*anchovia*". Measured vertically from the lower margin of the orbit to and including the lower jaw articulation, the cheek is deeper than the vertical diameter of the eye in the "*brasiliensis*" specimens, but equal to or just less than eye in "*anchovia*". This difference,

coupled with the closer approach of the pectoral tips to the pelvic base in *Sardinella brasiliensis* and the difference in gillrakers, suggests that there are indeed two species in Brazilian waters. Again, large samples are needed from many western Atlantic localities.

22. *Sardinella longiceps* Valenciennes, 1847
= *Sardinella longiceps* Valenciennes, 1847

Sardinella longiceps Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 273 (Pondichéry ; some poor and discoloured fishes, to 6 inches ; Bélanger).

TYPE MATERIAL. MNHN. 3743, 6 fishes, 105.7–124.5 mm. S.L., ex Pondicherry, coll. Bélanger (1829).

From these, the largest, a tagged fish, is chosen as lectotype, the remainder being paralectotypes.

DESCRIPTION. *Lectotype*, a fish of 124.5 mm. S.L., ex Pondicherry, coll. Bélanger, flaccid and not in good condition but fins undamaged, bearing paper registration tag, MNHN. 3743.

Br.St. 6, D iv 14, P i 15, V i 8, A ii 15, g.r. 236 + 255, scutes 19 + 14, scales (indet.). (gillraker count from Dr. F. Berry, pers. comm.).

In percentages of standard length : body depth 23.8, head length 34.4 ; snout length 9.6, eye diameter 6.2, upper jaw length 12.1, lower jaw length 16.0 ; pectoral fin length 16.0, pelvic fin length 8.7, length of anal fin base 12.9 ; pre-dorsal distance 54.7, pre-pelvic distance 59.6, pre-anal distance 81.2.

Body a little compressed, belly rounded and little keeled, head length $1\frac{1}{2}$ times greater than body depth. Snout greater than eye diameter. No teeth in jaws ; two supra-maxillae, the 2nd (posterior) of the *S. aurita* pattern (Figure 1a) but more pointed posteriorly.

Pseudobranch present, exposed, attenuated, its length $1\frac{1}{2}$ times eye diameter ; ventral border forming distinct ridge with a longitudinal groove below it for the reception of the tips of the hypobranchial gillrakers of the first arch. Gillrakers fine, slender, a little longer than corresponding gill filaments (posterior hemibranch), the latter equal to eye diameter ; epibranchial gillrakers on all arches curled upwards, cerato- and hypobranchial rakers on 3rd and 4th arches curled outwards. Fronto-parietal region with paired cuneiform areas bearing numerous longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{4}{5}$ eye diameter. Pectoral fin tip just failing to reach vertical from dorsal origin, failing to reach pelvic base by $1\frac{3}{4}$ eye diameters. Pelvic base below 9th branched dorsal ray, about equidistant between pectoral base and anal origin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ eye diameter ; last two rays enlarged ; alar scales present.

COLOUR : upper $\frac{1}{3}$ slate-coloured, remainder of flanks silver but discoloured (black) as a result of faulty preservation. Cheeks silver. Fins dark grey due to preservational discolouration.

IDENTIFICATION. Although closely related to *Sardinella aurita*, all authors have acknowledged *S. longiceps* as a distinct species which replaces the former in the Indian Ocean. The longer head and higher gillraker count are diagnostic, and

recently Chan (1965) has found a difference in the shape of the exposed portion of the interoperculum (see next species and Figure 1b).

23. *Sardinella neohowii* Valenciennes, 1847
= *Sardinella longiceps* Valenciennes, 1847

Sardinella neohowii Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 274 (Cananor ; some fishes, to 6 inches ; Dussumier).

TYPE MATERIAL. *MNHN*. 3744, 2 fishes, 120.6–123.0 mm. S.L., *ex* Cannanore or Mahé (Malabar coast), coll. Dussumier (1830).

The larger of the two is chosen as lectotype and the smaller as paralectotype. The jar has an old label "*Sardinella malhi* Cuv. Val. xx Mathi-à Mahé par Dussumier 1830."

DESCRIPTION. (Figures for the paralectotype placed in parentheses.)

Lectotype, a fish of 123.0 mm. S.L., *ex* Cannanore or Mahé, coll. Dussumier, in good condition, with external tag bearing reg. no., *MNHN*. 3744.

Paralectotype, a fish of 120.6 mm. S.L., from same bottle.

Br.St. 6, D iv 14 (iv 14), P i 15 (i 14), V i 8 (i 8), A iii 14 (1st minute) (ii 14), g.r. 217 (n.r.), scutes 19 + 15 (19 + 14), scales (indet.).

In percentages of standard length : body depth 23.8 (24.6), head length 31.0 (31.6) ; snout length 8.1 (8.3), eye diameter 6.1 (6.1), length of upper jaw 12.0 (11.7), length of lower jaw 14.7 (14.8) ; pectoral fin length 16.5 (16.0), pelvic fin length 9.0 (9.3), length of anal fin base 12.7 (12.5) ; pre-dorsal distance 48.4 (49.9), pre-pelvic distance 57.0 (56.2), pre-anal distance 80.3 (82.2).

Body moderately compressed, belly rounded, not keeled, body depth less than head length. Head long, post-orbital part 14.0 per cent. of S.L. Snout longer than eye diameter, the latter 19.7 (19.5) per cent. of head length. Two supra-maxillae, the 2nd (posterior) with lower portion of expanded part deeper than upper (as in *S. aurita*—Figure 1a).

Exposed portion of interoperculum as shown in Figure 1d. Gillrakers fine, slender, a little longer than corresponding gill filaments, just greater than eye diameter ; lower rakers of 2nd, 3rd and 4th arches folding outwards over those of arch in front. Fronto-parietal region with paired cuneiform areas bearing 9 longitudinal striae.

Dorsal fin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral tips falling short of vertical from dorsal origin by 1 pupil diameter ; failing to reach pelvic fin base by 2 eye diameters. Pelvic fin base nearer to anal origin than to pectoral base by 1 pupil diameter ; base below vertical from 9th branched dorsal ray. Anal fin origin nearer to caudal base than to pelvic base by $\frac{3}{4}$ pupil diameter.

Scales with slightly eroded but not fimbriated posterior borders, no horizontal striae on exposed portion ; unexposed portion with one large and 3 finer vertical striae, the latter interrupted in the centre of the scale ; alar scales present.

COLOUR : upper $\frac{1}{3}$ of body slate-coloured, rest of flanks golden. Faint spot (in paralectotype only) on posterior border of operculum at eye level. Tip of dorsal black, other fins hyaline.

IDENTIFICATION. The high gillraker count and long head distinguish these fishes from *Sardinella aurita*, although the interoperculum approaches the crescent shape described by Chan (1965 : fig. 5) for that species.

Regan (1917b), Fowler (1941 : 603) and other authors have all recognized this nominal species as a synonym of *S. longiceps*.

24. *Alausa scombrina* Valenciennes, 1847
= *Sardinella longiceps* Valenciennes, 1847

Alausa scombrina Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 442 (Cananor, Malabar Coast ; many fishes, to 8 inches ; Dussumier).

TYPE MATERIAL. MNHN. 3748, 7 fishes, 105.4–150.5 mm. S.L., ex Malabar, coll. Dussumier.

The largest (tagged) fish is here chosen as lectotype, the remainder being paralectotypes.

DESCRIPTION. *Lectotype*, a fish of 150.5 mm. S.L., ex Cananore, Malabar coast, coll. Dussumier, in good condition, bearing paper tag, MNHN. 3748.

Br.St. 6, D iv 13, P i 14, V i 8, A ii 14, g.r. 243 (some ant. rakers broken), scutes 19 + 15, scales (indet.).

In percentages of standard length : body depth 22.0, head length 34.0 ; snout length 8.8, eye diameter 6.7, upper jaw length 12.4, lower jaw length 15.5 ; pectoral fin length 17.3, pelvic fin length 9.3, length of anal fin base 10.7 ; pre-dorsal distance 49.0, pre-pelvic distance 59.0, pre-anal distance 83.0.

Body little compressed, belly rounded and barely keeled, head much greater than body depth. Snout greater than eye diameter. Maxilla and supra-maxillae as in lectotype of *S. longiceps*.

Pseudobranch present, exposed, as in *S. longiceps*. Gillrakers fine, slender, $1\frac{1}{5}$ times corresponding gill filaments, just over 1 eye diameter ; gillrakers curled as in lectotype of *S. longiceps*. Fronto-parietal region with paired cuneiform areas bearing about 8 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{3}{4}$ eye diameter. Pectoral fin tips almost reaching to vertical from dorsal origin, failing to reach pelvic base by $1\frac{1}{2}$ eye diameters ; a groove present above 1st pectoral ray into which the latter fits. Pelvic base below 8th branched dorsal ray, nearer to anal origin than to pectoral base by 1 pupil diameter ; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin nearer to caudal base than to pelvic base by $\frac{3}{4}$ eye diameter ; last two rays enlarged ; alar scales present.

Scales with posterior margins very faintly eroded and with some slight indications of horizontal ridges on exposed portion of scale ; unexposed portion with one large and 1–3 fainter vertical striae, the latter interrupted in the centre of the scale.

COLOUR : upper $\frac{1}{3}$ of body green-grey, remainder of flank silver, or gold where scale cover retained. A small semi-circular area lacking pigment at postero-dorsal angle of operculum, appearing as a black spot. Fins hyaline, but tips of anterior dorsal rays a little dark.

IDENTIFICATION. The high gillraker count and long head place this nominal species in *Sardinella longiceps* and not *S. aurita*. Valenciennes (1847 : 442) was struck by the size of the head in his *Alausa scombrina*, but the rigidity of his generic system prevented him from comparing it to *Sardinella longiceps*.

25. *Sardinella granigera* Valenciennes, 1847
= *Sardinella maderensis* (Lowe, 1839)

Clupea maderensis Lowe, 1839, *Trans. zool. Soc. London*, **2** (3) : 189 (Madeira).

Sardinella granigera Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 267 (Egypt ; 1 fish, 6½ inches ; Lefèvre).

TYPE MATERIAL. MNHN. 3225, 1 fish, 136.6 mm. S.L., ex Egypt, coll. Lefèvre.

DESCRIPTION. *Holotype*, a fish of 136.6 mm. S.L., ex Egypt, coll. Lefèvre (1830), caudal damaged, otherwise in fair condition, MNHN. 3225.

Br.St. 6, D v 15, P i 14, V i 7, A iii 19, g.r. 113, scutes 18 + 15, scales (indet.).

In percentages of standard length : body depth 25.5, head length 25.2 ; snout length 6.7, eye diameter 6.7, length of upper jaw 10.4, length of lower jaw 12.0 ; pectoral fin length 17.7, pelvic fin length 10.1, length of anal fin base 16.3 ; pre-dorsal distance 45.7, pre-pelvic distance 50.0, pre-anal distance 77.9.

Body moderately compressed, its depth equal to head length, belly not strongly keeled. Snout equal to eye. Two supra-maxillae present (Figure 2a), the 2nd (posterior) with lower portion of expanded part deeper than upper, but upper and lower profiles meeting anterior shaft at same point (thus closely resembling *Sardinella aurita*—Figure 1a) ; no hypo-maxillae. Small teeth in a single longitudinal series on tongue ; dentary symphysis slightly roughened.

Pseudobranch long, exposed, equal to eye diameter, with lower border forming a distinct ridge with a groove below it. Gillrakers fine, slender, 1½ times length of corresponding gill filaments, ¾ eye diameter ; rakers on lower half of 2nd–4th arches folded outwards, rakers on upper half of 1st arch folded upwards but not to the same extent as in *Sardinella aurita* ; mediopharyngobranchial present, bearing a few anterior gillrakers. Fronto-parietal region with paired cuneiform areas bearing 8 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by 1½ eye diameters. Pectoral fin tip failing to reach pelvic base by 1⅓ eye diameters, failing to reach vertical from dorsal origin by 1 pupil diameter. Pelvic base below 5th branched dorsal ray, equidistant between pectoral base and anal origin. The latter nearer to caudal base than to pelvic base by ¾ pupil diameter.

Scales with posterior borders prolonged (Figure 2b), the prolongation bearing horizontal ridges and lines of small perforations ; unexposed portion of scale with one large and several finer vertical striae, the latter reaching to scale centre and often overlapping each other.

COLOUR : upper ⅓ of body grey, rest of flanks silver ; a prominent dark spot at base of anterior dorsal rays ; other fins hyaline.

IDENTIFICATION. Regan (1917b) tentatively included *Sardinella granigera* in the synonymy of *S. maderensis* (Lowe), distinguishing the latter species from *S. eba* (Valenciennes) by its fewer gillrakers (60–95; cf. 110–130 in *S. eba*) and from *S. cameronensis* Regan by its more slender body (depth $3\frac{3}{8}$ –4 times in S.L.; cf. 3 times in *S. cameronensis*). The synonymy *granigera* = *maderensis* was generally accepted (e.g. Chabanaud, 1934; Furnestin, 1952; Dieuzeide *et alii*, 1954), but it was questioned by Postel (1959) and by Tortonese (1961). The latter suggested that *S. granigera* differed from *S. maderensis* in gillraker number (more than 100; cf. less than 100 in *S. maderensis*), in having a greater degree of perforation of the scales, and in body shape. In turn, Ben-Tuvia (1960) could find no significant differences between the types of *S. maderensis*, *S. granigera*, *S. eba* and *S. cameronensis* and could not correlate variations in body depth with a geographical factor, the whole range from slender to deep fishes (depth 3.0–4.0 times in S.L.) occurring in his samples from the Eastern Mediterranean alone. Ben-Tuvia (*loc. cit.*) gave a range of 70–166 gillrakers, but this may have been derived from the literature covering all four species.

For the present, and until large collections have been examined and the separation on gillrakers confirmed, *Sardinella granigera* will be considered a synonym of *S. maderensis*.

Chabanaud (1926) recognized three genera within Regan's concept of *Sardinella*—*Sardinella*, *Clupeonia*, and *Amblygaster*—based on pelvic rays (9 in *Sardinella*, 8 in the other two), the form of the glossohyal plate, etc. These divisions, expressed as subgeneric divisions by Whitehead, *et alii* (1966), seem to represent a useful grouping of the species of *Sardinella*. The development of a high number of gillrakers and microphagous feeding habits in *Sardinella sensu strictu* (*S. aurita* and allies) parallels a similar trend in the shads (Alosinae). In both cases the epibranchial rakers of the first arch tend to curl outwards, and the hypobranchial rakers of the other arches do the same, presumably to form an efficient filtration basket. At the same time, a

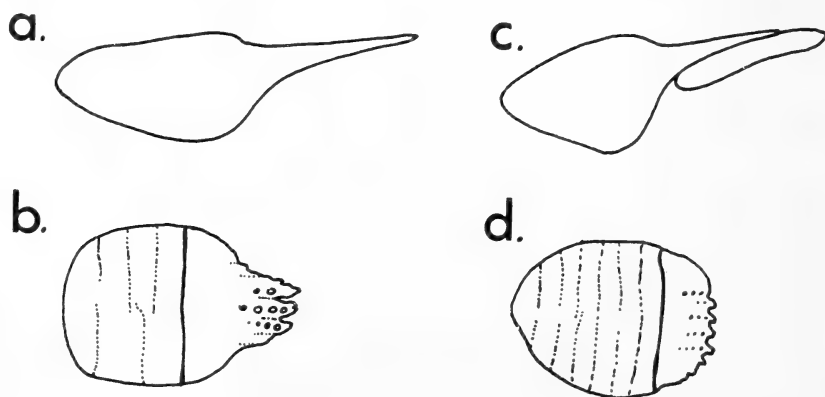


FIG. 2. Supra-maxilla shape and scales in *Sardinella maderensis*. a, b. *S. granigera* holotype, 136.6 mm. S.L. (MNHN. 3225). c, d. *Alausa eba* lectotype, 220 mm. S.L. (MNHN. 3).

most noticeable feature in many such species is the development of a ridge along the lower edge of the pseudobranch below which is a groove. The hypobranchial gill-rakers of the first arch fit into this groove. These features are mentioned because they occur also in *Sardinella maderensis*, suggesting that this species has progressed further than any other member of the *Clupeonia*-group towards a microphagous diet (mainly small members of the zoo- and phytoplankton—Ben-Tuvia, 1960 : 507).

26. *Alausa eba* Valenciennes, 1847
= *Sardinella maderensis* (Lowe, 1839)

Alausa eba Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 417 (Gorée ; no number or size ; Rang, and Adanson).

TYPE MATERIAL. *MNHN*. 3, 2 fishes, 178.0–220.0 mm. S.L., ex Gorée (Senegal), coll. Rang (1830).

The larger of the two is selected as lectotype.

DESCRIPTION. (Figures for paralectotype given in parentheses.)

Lectotype, a fish of 220.0 mm. S.L., ex Gorée, coll. Rang, in good condition, *MNHN*. 3.

Paralectotype, a fish of 178.0 mm. S.L., ex Gorée, coll. Rang, in good condition, *MNHN*. 3.

Br.St. 6 (6), D iv 15 (iv 15), P i 15 (i 15), V i 7 (i 7), A ii 18 (iii 18), g.r. 142 (n.r.), scutes 18 + 14 (18 + 15), scales (n.r.).

In percentages of standard length : body depth 28.8 (30.2), head length 25.1 (26.2) ; snout length 6.8 (7.3), eye diameter 5.4 (6.1), length of upper jaw 10.2 (10.5), length of lower jaw 10.9 (11.9) ; pectoral fin length 18.3 (17.3), pelvic fin length 8.6 (9.2), length of anal base 13.9 (14.2), length of caudal fin 29.0 (n.r.) ; pre-dorsal distance 43.8 (46.2), pre-pelvic distance 49.8 (48.7) pre-anal distance 76.4 (76.0).

Body moderately compressed, belly little keeled, smooth, body depth a little greater than head length. Snout greater than eye diameter. Maxilla with smooth lower edge ; two supra-maxillae (Figure 2c), the 2nd (posterior) with lower part of expanded portion deeper than upper part (as in *S. aurita*, Figure 1a) ; no hypomaxillae. Teeth absent from jaws ; a single series of small teeth on tongue in paralectotype (none in lectotype).

Pseudobranch exposed, moderately long, a little greater than eye diameter, lower edge ridged with groove below. Gillrakers fine and slender, just longer than corresponding gill filaments, about equal to eye diameter ; gillrakers on 1st epibranchial and on hypobranchials of remaining arches, curled outwards. Fronto-parietal region with paired cuneiform areas bearing 8 longitudinal ridges.

Dorsal fin origin nearer to snout tip than to caudal base by 3 (2) eye diameters. Pectoral fin tips reaching vertical from 2nd branched dorsal ray, failing to reach pelvic base by 1 ($1\frac{1}{3}$) eye diameter. Pelvic base below 8th (6th) branched dorsal ray, nearer to pectoral base than to anal origin by $\frac{2}{3}$ (almost 1) eye diameter. Anal origin nearer to caudal base than to pelvic base by $\frac{2}{3}$ eye diameter ; last two anal rays enlarged.

Scales eroded and bearing longitudinal ridges and perforations on exposed portion (Figure 2d), but the posterior margin not produced as in the type of *S. granigera*; one large and 3-4 (anterior scales) or many (posterior scales) smaller vertical striae, the latter failing to meet in the centre of the scale (anterior scales) or continuous or interdigitating (posterior scales).

COLOUR : upper $\frac{1}{3}$ of body slaty-gold, remainder of flanks golden. A dark spot at base of anterior dorsal rays.

IDENTIFICATION. Regan (1917b) distinguished *S. eba* from *S. maderensis* by its higher gillraker count (100-130; cf. 60-95 in *S. maderensis*). Tortonese (1961) followed Postel (1959) in separating the more euryhaline *S. granigera* from the more stenohaline *S. maderensis*, placing *S. eba* in the synonymy of the former. As stated under *S. granigera*, Ben-Tuvia (1960) combined all three species. As yet, no convincing figures have been given of the range and variation of meristic characters in these two (or three) species based on specimens from throughout their geographical range. For the present, *Sardinella eba* will be considered a further synonym of *S. maderensis*.

27. *Spratella fimbriata* Valenciennes, 1847
= *Sardinella fimbriata* (Valenciennes, 1847)

Spratella fimbriata Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 359 (Malabar; fishes of 6 inches; Dussumier).

TYPE MATERIAL. MNHN. 3227, five fishes, 106.4-123.1 mm. S.L., ex Malabar, coll. Dussumier (1837).

From these, the tagged specimen has been designated lectotype and the remainder paralectotypes.

DESCRIPTION. (Figures for the four paralectotypes are given in parentheses.)

Lectotype, a fish of 120.2 mm. S.L., ex Malabar, coll. Dussumier, in good condition, bearing paper tag, scales retained, MNHN. 3227.

Paralectotypes, four fishes of 106.4-123.1 mm. S.L., from same locality, left flank cut in two largest, MNHN. 3227.

Br.St. (n.r.), D iv 15 (iv-v 14-16, total 18-20), P i 14 (i 14-15), V i 7 (i 7), A ii 17 (iii 15-18), g.r. 77 (81, 74, 79, 57), scutes 18 + 14 (18 + 13-15), scales (45 *fide* Chabanaud, 1926).

In percentages of standard length : body depth 32.7 (30.0-34.1), head length 26.7 (25.7-27.7); snout length 6.7 (6.7-7.6), eye diameter 7.1 (6.8-7.7), length of upper jaw 10.5 (10.3-11.3), length of lower jaw 11.1 (11.3-11.8); length of pectoral fin 18.0 (16.2 and 18.4-18.7), length of pelvic fin 11.2 (9.1 and 10.6-11.4), length of anal fin base 17.9 (15.1-15.7 and 17.8); pre-dorsal distance 45.2 (46.5-48.0), pre-pelvic distance 53.5 (50.5 and 52.8-54.3), pre-anal distance 77.5 (77.8-80.0).

Body compressed, its width $2\frac{3}{4}$ times in body depth, belly keeled. Snout usually a little smaller than eye diameter. Maxilla with smooth lower edge; two supra-maxillae, the 2nd (posterior) with upper and lower portions of expanded part about equal in shape and size, their upper and lower profiles meeting the anterior shaft of the bone at about the same point; no hypo-maxillae. A few minute teeth present at dentary symphysis.

Pseudobranch exposed, base crescentic, its length equal to eye diameter. Fronto-parietal region with paired cuneiform areas bearing about 11 longitudinal striae. Gillrakers slender, equal in length to corresponding gill filaments and about $\frac{1}{2}$ eye diameter.

Dorsal fin in low scaly sheath, first unbranched ray minute in two smaller paracletotypes, dorsal origin nearer to snout tip than to caudal base by $1\frac{1}{2}$ eye diameters. Pectoral fins failing to reach pelvic base by $\frac{1}{4}$ eye diameter ; a recess present above first pectoral ray into which the latter fits. Pelvic base below 5th branched dorsal ray, equidistant between pectoral base and anal origin ; axillary scale present, just over $\frac{1}{2}$ length of fin. Anal origin equidistant between pelvic and caudal bases ; last two rays enlarged ; whole fin set in low scaly sheath.

Scales with exposed portion eroded and fimbriated posteriorly and bearing fine longitudinal ridges and small perforations, the latter not set in distinct longitudinal lines (cf. *Sardinella granigera* type) ; unexposed portion of scale with one large and 3-4 vertical striae, the latter not meeting in the centre of the scale.

COLOUR : upper $\frac{1}{3}$ of body slate coloured, rest of flanks golden. Dorsal fin with dark patch at base of anterior rays and a dusky margin to fin ; caudal tips dusky.

IDENTIFICATION. The problem of the identity of *Sardinella fimbriata*, and its relationship with *Sardinella jussieu* (Lacep.) (i.e. *S. gibbosa* (Bleeker) as accepted by Regan (1917b), Dutt (1959) and here), has been outlined previously (Whitehead, 1965b) in relation to Red Sea specimens. The main difficulty is the differentiation of the two species on gillraker counts when in each case gillrakers show positive allometry (increase) with body length, with considerable overlap when the size of fish is not specified. The following table is compiled from Dutt (1959, 1965b), based on Indian specimens.

GILLRAKERS ON LOWER ARM

cm. length group	<i>Sardinella gibbosa</i>		<i>Sardinella fimbriata</i>	
	Range	Mean	Range	Mean
3	34-37	36	39-41	40
4	39-43	41	41-49	45
5	42-45	43	48-54	51
6	43-47	44	53-61	56
7	43-50	46	56-65	59
8	43-52	48	57-71	63
9	46-56	52	64-72	66
10	47-59	53	64-74	69
11	48-60	56	62-77	70
12	49-60	56	64-81	70
13	48-63	56	63-80	71
14	49-63	56	67-80	72
15	49-63	57	—	—
	298 fishes		624 fishes	

The species are distinct except for slight overlap in the 4 and 13 cm. length groups. Dutt (1959, 1961b) also showed a slight difference in pectoral finrays between the two species (M.14.89 in *S. gibbosa* ; M.15.40 in *S. fimbriata*) and a slight difference in vertebral counts (range 45-47, mode 46 in *S. gibbosa* ; range 44-46, mode 45 in

S. fimbriata). More important perhaps (but perhaps not unconnected with meristic variations—see Ben-Tuvia, 1963, 1964 for *S. aurita*), Dutt (1959) stated that along the Waltair coast, *S. fimbriata* appears earlier in the season than *S. gibbosa* (October–November; cf. November–January). During April and May, when the two species are about equally represented in the fishery, Dutt (*loc. cit.*, p. 287) states that “Although the two species occur in the same region, their shoals remain discrete . . . even in catches of shore seines, which are perhaps the least selective of the local gear, as far as species representation is concerned.”

Material from the Red Sea region (Whitehead, 1965b) was satisfactorily separated into the two species on the basis of Dutt’s gillraker figures; no other meristic differences were found but in *S. gibbosa* the snout was slightly shorter (6.4–7.3 per cent. of S.L.; cf. 6.7 and 7.3–8.0 per cent. of S.L.). Snout length figures given here for the syntypes of *Spratella fimbriata* (6.7–7.6 per cent. of S.L.) span the gap between the two species, while snout length in the putative neotype of *Clupea gibbosa* Bleeker is 6.7 per cent. of S.L. (Whitehead, *et alii*, 1966).

While there are some species problems capable of solution by museum methods, the *fimbriata-gibbosa* problem is essentially one for the field. Dutt’s gillraker differences may hold good in Indian waters, but East African or Indonesian specimens could easily transcend the narrow limits suggested by Dutt’s figures. The influence of exogenous factors, especially temperature, on developmental rates and thus number of body parts, cannot be discounted.

Note. Günther (1868 : 426) combined *S. fimbriata* and *S. gibbosa* on the basis of a Bleeker specimen of each (both are in fact *S. gibbosa*—Whitehead, *et alii*, 1966). Regan (1917b), with true *S. fimbriata* to hand (Indian and Malayan), was the first to separate the two (on gillrakers mainly), and Fowler (1941) and others have followed this. Chabanaud (1926) measured the present lectotype of *Spratella fimbriata* and kept the species distinct from Bleeker’s *Spratella tembang* (i.e. *S. gibbosa*), but Bertin (1944) identified *S. fimbriata* with *S. jussieu* (Val.), a very different species (see p. 59).

KOWALA Valenciennes, 1847
= **SARDINELLA** Valenciennes, 1847

Kowala Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 362 (Type : *Kowala albella* Valenciennes, designated by Gill, 1861).

As on previous occasions, Valenciennes’ reliance on dentition stimulated the erection of yet another genus of sardine-like fishes. Voici encore, he writes, une nouvelle combinaison dans la disposition des dents des clupéoides : teeth present in jaws and on pterygoids only. This formula concealed two species belonging to very different genera, *K. albella* (= *Sardinella*) and *K. thoracata* (= *Escualosa*). Gill (1861) followed by Jordan (1919 : 231), designated the first as type of the genus. Regan (1922), on the other hand, chose the second, and authors have until recently recognized a genus *Kowala* Regan, placed erroneously in the subfamily Pellonulinae. The status of *Kowala* and its synonymy is discussed later (p. 72).

28. *Kowala albella* Valenciennes, 1847
= *Sardinella albella* (Valenciennes, 1847)

Kowala albella Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 362 (Pondicherry ; two fishes, 3½ inches ; Leschenault and Reynaud).

Clupalosa bulan Bleeker, 1849, *Verh. Bat. Gen. (Madura)*, **22** : 12 (Madura strait and Java Sea).

TYPE MATERIAL. MNHN. 665, 1 fish, 71.2 mm. S.L., ex Pondicherry, coll. Reynaud (1825).

MNHN. 3231, 1 fish, 70.5 mm. S.L., ex Pondicherry, coll. Leschenault (1818).

The first of these is chosen as lectotype since the first gill arch on both sides is damaged in the Leschenault specimen.

DESCRIPTION. (Figures for paralectotype placed in parentheses.)

Lectotype, a fish of 71.2 mm. S.L., ex Pondicherry, coll. Reynaud, in good condition but some scales lost, MNHN. 665.

Paralectotype, a fish of 70.5 mm. S.L., ex Pondicherry, coll. Leschenault, in fair condition but gill arches damaged, MNHN. 3231.

Br.St. (n.r.), D iv 15 (iv 15), P i 14 (i 14), V i 7 (i 7), A iii 19 (iii 18), g.r. 26 + 47 (28 + 50), scutes 18 + 13 (17 + 13), scales (indet.).

In percentages of standard length : body depth 33.7 (31.9), head length 25.0 (26.8) ; snout length 6.6 (6.4), eye diameter 7.4 (7.4), length of upper jaw 10.5 (10.8), length of lower jaw 11.2 (12.1) ; pectoral fin length 17.8 (damaged), length of pelvic fin 10.5 (10.7), length of anal base 17.1 (16.9) ; pre-dorsal distance 45.3 (46.4), pre-pelvic distance 55.0 (55.3), pre-anal distance 78.7 (78.4).

Body compressed, its width a little over 3 times in its depth, belly keeled ; head less than body depth. Snout a little shorter than eye diameter. Two supra-maxillae, the 2nd (posterior) with upper and lower portions of expanded part about equal in shape and size. Fronto-parietal region with paired cuneiform areas bearing about 7 longitudinal striae.

Dorsal nearer to snout tip than to caudal base by 1¼ eye diameters. Pelvic base below 5th branched dorsal ray, equidistant between pectoral base and anal origin. Anal origin a little nearer to caudal base than to pelvic base.

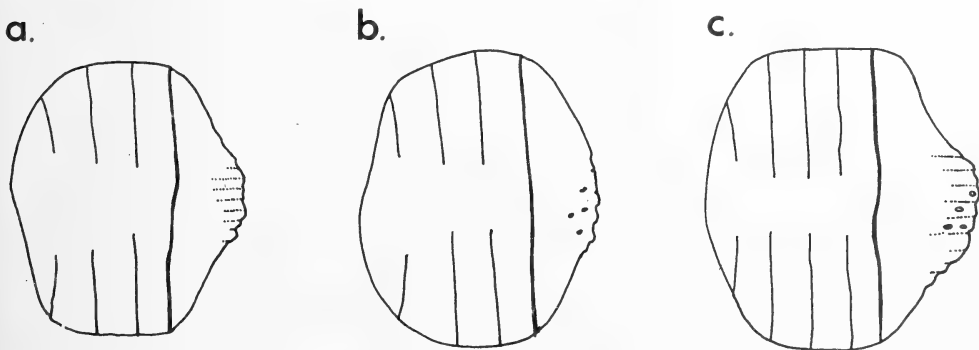


FIG. 3. Scales from anterior, middle and posterior flank of lectotype of *Kowala albella*, 71.2 mm. S.L. (MNHN. 665).

COLOUR : upper $\frac{1}{4}$ of body slate coloured, remainder of flanks silver, or gold where scale cover retained. Base of anterior dorsal rays with black spot ; caudal tips faintly dusky in paralectotype.

IDENTIFICATION. Regan (1917b) tentatively, and Fowler (1941 : 605) positively, identified *Kowala albella* with *Sardinella brachysoma* Bleeker. Chan (1965) ignored *Kowala albella*, but would certainly not have identified it with *S. brachysoma* had he been able to examine the scales (Figure 3). In *Sardinella brachysoma* the posterior scales have an increasing number of vertical striae that are continuous and not interrupted in the centre of the scale (Chan, *loc. cit.*, fig. 9). In most other members of the genus, the vertical striae are interrupted in the centre of scales from all parts of the body, a fact first noted by Regan (1917b). In the key given by Whitehead, *et alii* (1966), *Sardinella brachysoma* was separated from the closely similar *S. bulan* (Bleeker) (i.e. *S. perforata* of Regan and Fowler) principally because its scales are more strongly perforated, ridged and fimbriated posteriorly. This difference is shown in Figure 4a-f. The two specimens chosen were almost the same length but differed noticeably in body depth (*S. brachysoma* 36.8 per cent. of S.L. ; *S. bulan* 33.1). Unfortunately both body depth and the degree of perforation, ridging and erosion of the scale margin increase with size of fish. Nonetheless, the scales of the lectotype of *Kowala albella* closely resemble those of *S. bulan* : the perforations are fewer but larger, the horizontal striations and ridges are barely developed, and the main vertical striae are neither so numerous nor joined in the centre as in *S. brachysoma*.

Future work on large samples may justify lumping the two species together, but while they remain separate then *Kowala albella* must be identified with and take priority over *S. bulan*.

29. *Clupanodon jussieu* Lacepède, 1803 = *nomen dubium*

Clupanodon jussieu Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 469, 471, ? pl. 11, fig. 2 (on *Grande Sardine de l'Ile de France* of Commerson).

TYPE MATERIAL. There is no material which could have formed the basis of either Lacepède's or Commerson's description.

IDENTIFICATION. The salient points in Lacepède's description are :

D 16, P 16, V 7, A 22, C 24, vert. 54, ribs 25. Caudal forked ; small scales on base. Pelvics small ; pectorals folding into groove. No lateral line. Dorsal base in a furrow formed by scales. Lower jaw in advance of upper ; tongue short and soft. Operculum striated.

Colour : back bluish, flanks and belly silver ; pectorals flesh-coloured ; scales bright and flexible.

Size : intermediate between a sardine and a herring.

The overall impression given by this description is of a species of *Herklotsichthys* or *Sardinella*, although *Hilsa* is also possible. The pelvic count of 7 is almost certainly incorrect since all these genera have 17 rays, as also do *Dussumieria* and *Etrumeus* ; no Engraulidae (pelvic 16) are likely to be implicated. The remaining meristic counts, which may also be inaccurate, are not diagnostic of any of these

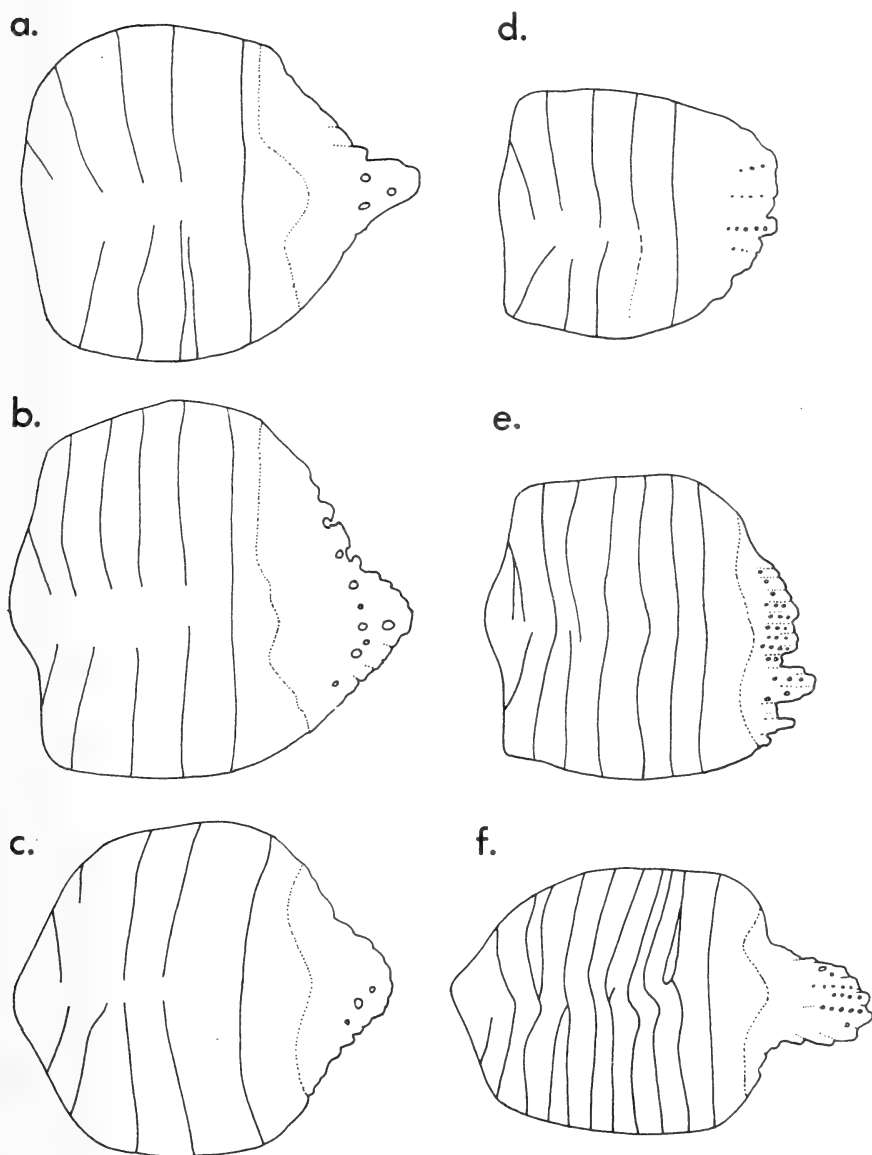


FIG. 4. Scale striation pattern and perforations in *Sardinella albelli* and *S. brachysoma* (scales from anterior, middle and posterior part of flank). a, b, c. *Sardinella albelli*, 88.5 mm. S.L. (BMNH. 1880.2.2.98—'Malayan Seas'). d, e, f. *Sardinella brachysoma*, 89.5 mm. S.L. (BMNH. 1864.12.12.23—Vana).

genera but (apart from the vertebral count) could certainly apply to species of *Herklotsichthys*, *Sardinella* and *Hilsa*. The dorsal fin sheath, the pectoral groove, the scaled caudal and the small pelvics are all very characteristic of *Hilsa kelee* (Cuvier). In that species, however, a dark humeral spot is present, followed in some specimens by a series of dark spots along the flanks (Whitehead, 1965a : 133), a feature which Commerson would certainly have recorded. *Hilsa kelee* has dark borders to the dorsal and caudal fins, a feature shown in Lacepède's plate 11, figure 3 labelled "*Variété du CLUPANODON Jussieu*" (but see below and discussion, p. 63).

But whereas *Hilsa kelee* is the only species of *Hilsa* recorded from the East and South African coast, there are a number of species of *Sardinella* and one species of *Herklotsichthys* (*H. punctatus*) and Lacepède's description offers no clue as to which was intended.

Valenciennes believed that he had solved the problem of the identity of *Clupanodon jussieu* by reference to a specimen from the type locality collected by Dussumier. This specimen has a very high gillraker count (95) and thus resembles *Sardinella dayi* Regan. It is, however, considered distinct from the latter species here.

Günther (1868 : 430), who had no specimens, equated Lacepède's *Clupanodon jussieu* (and his plate 11, figure 2) with Valenciennes's *Clupeonia jussieu*. Regan (1917b) tentatively did the same, but identified these as possible senior synonyms of *Clupea gibbosa* Bleeker. Since then, authors have been undecided whether to use the name "*jussieu*" or "*gibbosa*" for a species of *Sardinella* closely related to *S. fimbriata* Valenciennes.

There is no question that the holotype of *Clupeonia jussieu* Valenciennes is quite distinct from both *Sardinella fimbriata* and *Sardinella gibbosa*, these two species having a much lower gillraker count (respectively maximum 72 and maximum 57 in Indian material—Dutt, 1959, 1961b). The question is primarily whether the name "*jussieu*", if not a senior synonym of Bleeker's "*gibbosa*", should continue to date from Lacepède and if so, whether it should (rather arbitrarily) be identified with Valenciennes' *Clupeonia jussieu*.

Lacepède's plate 11, figure 2, labelled "*Variété du CLUPANODON chinois*" (shown here as Plate 3b), was believed by Valenciennes (1847 : 346, footnote) to illustrate Lacepède's *Clupanodon jussieu*. The figure was based on a Commerson drawing (Plate 3a here). It shows a moderately deep-bodied clupeid fish (depth 30.7 per cent. of S.L.), but scutes are clearly present (thus eliminating *Dussumieria* and *Etrumeus*). The caudal tips are plain and there are no spots along the flanks (cf. *Hilsa* and *Sardinella sirm*). The head is small (22.3 per cent. of S.L.) and the general appearance of the fish strongly suggests an elongate species of *Sardinella*. The absence of spots along the flank rules out *S. sirm*, the head is too short for *S. longiceps*, but *S. clupeoides* is quite possible. So also is the species with which this drawing has most often been identified, *S. gibbosa* (Bleeker). One apparent distortion in the figure is the advanced position of the dorsal fin (pre-dorsal distance only 37.7 per cent. of S.L.), a feature which Lacepède's artist de Sève exaggerated even further (34.4 per cent.). Even in *Hilsa kelee* the minimum pre-dorsal distance recorded is 41.7 per cent. of S.L. (Whitehead, 1965a : 132).

There is, however, a more serious difficulty in attempting to identify *Clupanodon jussieu* from this drawing. The drawing was almost certainly accompanied by notes, and the probability that Lacepède built his description on notes is increased by the fact that Lacepède not only gave fin ray counts, but also vertebral and even rib counts for his *Clupanodon jussieu*. The vertebral count of 54 is too high for *Herklotsichthys* (around 44, Regan, 1917b), *Hilsa* (44-46 in *H. ilisha*, Whitehead, 1965a) or *Sardinella* (44-46, Regan, 1917b ; to 50 in *S. aurita*, Ben-Tuvia, 1960). A count of 54 is quite normal for *Dussumieria* (Whitehead, 1963a), and Regan (*loc. cit.*) records up to 52 for *Sardinops sagax* ; but the figure does not depict either of these fishes. Taken together, there is no known clupeid fish that combines features of both the description and the figure, which raises the possibility that the Commerson notes did not refer to this drawing. Lacepède did not, in fact, refer in the text either to his figure 2 or to his figure 3 on the same plate (his *Variété du CLUPANODON jussieu*). Valenciennes (1847: 351) stated that figure 3 was not accompanied by notes and the same might be true of figure 2. Both figures are labelled " variété ", which suggests that they may have played a subsidiary role in the Lacepède descriptions. There is also the possibility that figure 2, the " *Variété du CLUPANODON chinois* ", may have been associated by Lacepède with his *Clupanodon sinensis* (Linn.). He gave a length of " deux ou trois décimètres " for the latter, which rules out all species of *Herklotsichthys* and *Sardinella* except perhaps *S. aurita*. The true identity of the Linnaean *Clupea sinensis*, as well as Bloch's *C. sinensis* (which may not have been the same), is still controversial (see p. 91). Valenciennes believed that the name " *sinensis* " of Linnaeus and Lacepède " doit être rayé de nos catalogues ichthyologiques " and nothing in the intervening century has been found to contradict this advice.

The conclusion that can be drawn from all this is that *Clupanodon jussieu* Lacepède cannot be identified with certainty, either from the text or from the text in combination with the figure (even if such a combination was intended, which seems unlikely). There is something to be said for attaching the name arbitrarily to *Clupeonia jussieu* Valenciennes. A Lacepède name would be unlikely to fall into synonymy. But unfortunately, Lacepède's name " *jussieu* " has become attached to quite another species, i.e. to Bleeker's " *gibbosa* ". To validate Lacepède's " *jussieu* " by designation of a " *gibbosa* " neotype is undesirable since there is no certainty that Bleeker's " *gibbosa* " necessarily extends from the East Indies to Mauritius, the type locality of " *jussieu* ". The systematics of this group of *Sardinella* still requires attention, especially since gillrakers, on which the separation of the species is mainly based, increase with size of individual in many species and may well vary with geographical and environmental factors.

To rid the nomenclature of the doubts and confusion centering round the name " *jussieu* ", it is recommended that this Lacepède name be suppressed as a *nomen dubium*, and application will be made to the International Commission.

CLUPEONIA Valenciennes, 1847

Clupeonia Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 345 (Type : *Clupeonia jussieu* Valenciennes, designated by Gill, 1861, *Proc. Acad. nat. Sci. Philad.* : 35).

Clupeonia is nowadays considered at most merely a subgenus of *Sardinella*. Unfortunately, the definition of *Clupeonia* is obscured by the *jussieu-jussieu-gibbosa* confusion already alluded to. The first type designation for *Clupeonia* was that of Gill (1861), who gave the type species as "*Clupeonia jussieu* Val." followed by the statement "*Syn* : *Clupanodon jussieu* Lac.". Hitherto, the two have often been considered synonymous, and both were thought to be senior synonyms of *Sardinella gibbosa* (Bleeker). But *Clupanodon jussieu* Lacepède is shown here to be beyond certain identification (see above), while *Clupeonia jussieu* Valenciennes is shown to be quite different from subsequent concepts of both *Clupanodon jussieu* Lacepède and *Sardinella gibbosa* (Bleeker). The true diagnosis of *Clupeonia* must be re-examined.

In designating type species for the 17 genera of clupeids, Gill (*loc. cit.*) sometimes listed an older name below the type species against a heading "*Syn* : ". His intention appears to have been the designation of a type species of whose identity he was certain, followed by the probable senior synonym, which was usually a poorly described species. But since there is no evidence that he did more than read Valenciennes' description of *Clupeonia jussieu*, can one assume that he had any particular concept of the genus beyond what he read? It can be argued that modern authors, such as Fowler (1941) and Chan (1965), who also never examined the holotype of Valenciennes' *Clupeonia jussieu*, but also assumed the Lacepède and Valenciennes species to be synonymous, have thereby tacitly established the type of *Clupeonia* as a nominal species (i.e. Lacepède's *Clupanodon jussieu*) identical to Bleeker's *Clupea gibbosa*. This is, indeed, the sense in which *Clupeonia* has been understood hitherto.

Against this, there is the fact that the holotype of the type species chosen by Gill (i.e. *Clupeonia jussieu*) is still extant, was as fully described as any other Valenciennes species and, while misidentified hitherto, could now be used to characterize the subgenus *Clupeonia*. If, as recommended here, Lacepède's *jussieu* is regarded as a *nomen dubium*, then there is every good reason to ignore its appearance in Gill's paper. This gives *Clupeonia* a new and rather controversial position because of uncertainties regarding the identity of the holotype of *Clupeonia jussieu* Val. (see below).

A third, but clearly wrong, interpretation of *Clupeonia* was put forward by Chabanaud (1926), who claimed that the type of *Clupeonia jussieu* Valenciennes was lost, perhaps permanently, and who then based his diagnosis of *Clupeonia* on the next species, *Clupeonia fasciata*. Chabanaud (*loc. cit.*) noticed that his own diagnosis was thereby "en contradiction flagrante" with Valenciennes' diagnosis—a not unexpected result, for the holotype of *C. fasciata* is not a *Sardinella* at all, but *Herklot-sichthys punctatus* (see p. 34).

The identity of *Clupeonia* may prove to be important in any future revision of the genus *Sardinella*. Chabanaud's solution is clearly wrong, but he and Bertin (1940, 1944) are virtually the only recent authors to recognize *Clupeonia* as a genus. Both

authors use *Clupeonia* as a group to include all *Sardinella* species not falling within the genera (or subgenera) *Sardinella* and *Amblygaster*. In this sense, *Clupeonia* includes both *Clupea gibbosa* (Bleeker) as well as *Clupeonia jussieui* Valenciennes, and Chabanaud's diagnosis does not exclude either species. Therefore, to restrict *Clupeonia* by recognizing *Clupeonia jussieui* Valenciennes as type of the genus does not conflict with Chabanaud, Bertin or any recent author.

The type of *Clupeonia* is, therefore, recognized here as *Clupeonia jussieui* Valenciennes, a species closely allied to Regan's *Sardinella dayi*. *Clupeonia* can be defined as including those *Sardinella* species with,

- a. 8 pelvic rays
- b. trenchant ventral scutes
- c. upper and lower parts of expanded portion of 2nd supra-maxilla about evenly developed
- d. pseudobranch short, without ventral ridge (except *S. maderensis*)
- e. epibranchial gillrakers not or barely curled upwards, not overlapped by ceratobranchial gillrakers
- f. a double row of median pre-dorsal scales.

As thus defined, *Clupeonia* contains the following nine species,

Sardinella jussieui (Valenciennes)

Sardinella dayi Regan

Sardinella maderensis (Lowe) (*sensu* Ben-Tuvia, 1959)

Sardinella brachysoma Bleeker

Sardinella fimbriata (Valenciennes)

Sardinella zunasi (Bleeker)

Sardinella albella (Valenciennes) (including *S. bulan*)

Sardinella gibbosa (Bleeker) (including *S. sindensis*, see Chan, 1965 : 11)

Sardinella melanura (Cuvier)

Valenciennes (1847) included five species in his genus *Clupeonia* (Table 3). He based the genus solely on dentition (teeth present only on tongue and pterygoids).

30. *Clupeonia jussieui* Valenciennes, 1847

= *Sardinella jussieui* (Valenciennes, 1847)

Clupeonia jussieui Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 346, pl. 599 (Ile-de-France ; 1 fish, 7 inches ; Dussumier).

TYPE MATERIAL. MNHN. A.2208, 1 fish, 139.6 mm. S.L., *ex* Mauritius, coll. Dussumier.

DESCRIPTION. *Holotype*, a fish of 139.6 mm. S.L., *ex* Mauritius, coll. Dussumier, right side of body cut, right lower jaw cut, anterior scales shed, MNHN. A.2208.

Br.St. (n.r.), D iv 15, P i 15, V i 7, A iii 18, g.r. 95, scutes 17 + 13, scales (indet.).

In percentages of standard length : body depth 29.8, head length 24.6 ; snout length 6.4, eye diameter 6.3, upper jaw length 10.5, lower jaw length 10.7 ; pectoral length 16.6, pelvic length 11.0, length of anal base 17.1 ; pre-dorsal distance 45.2, pre-pelvic distance 52.3, pre-anal distance 78.3.

Body moderately compressed, its width $2\frac{1}{2}$ times in its depth, the latter greater than head length; belly moderately keeled. Snout length equal to eye diameter. Maxilla reaching to vertical from eye centre, lower border smooth; two supra-maxillae, the 2nd (posterior) with upper and lower parts of expanded portion about equal in size and shape; no hypo-maxillae. No teeth in jaws.

Pseudobranch present, exposed, its length equal to eye diameter. Gillrakers very fine and slender, close-set, almost equal to length of corresponding gill filaments, about $\frac{1}{2}$ eye diameter. Fronto-parietal region with paired cuneiform areas bearing 7-9 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $2\frac{1}{4}$ eye diameters. Pectoral fin tips failing to reach pelvic fin base by 2 eye diameters, failing to reach vertical from dorsal origin by $\frac{3}{4}$ eye diameter. Pelvic base below 5th branched dorsal ray, slightly nearer to pectoral base than to anal origin; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ pupil diameter; last two anal rays enlarged.

Scales with one large and 3-5 (anterior scales) or 5-7 (posterior scales) finer vertical striae, the finer striae interrupted at the centre of the scale; posterior edge of scale barely eroded, only faintly striated or ridged longitudinally, but with no perforations. No alar scales.

COLOUR: upper $\frac{1}{3}$ of body slate-coloured, rest of flanks golden; dorsal fin with dark patch at base of anterior rays and dusky fringe to tips of all rays; caudal with dusky tips; other fins hyaline.

IDENTIFICATION. Neither the key given by Chan (1965), nor that given by Whitehead, *et alii* (1966), fully resolves the problem of identifying *Sardinella* material, particularly when the specimens come from areas far distant from the type localities of the species concerned. In the present case, the high gillraker count of 95 eliminates all the Indo-Pacific species of the "*Clupeonia*" group (subgenus *Clupeonia* of Whitehead *et alii*, *loc. cit.*), except *Sardinella dayi* Regan. Regan (1917b) described 130 gillrakers in the holotype (109 mm. S.L.) (I count 124) and Chan (*loc. cit.*) gave counts of 88 and 103 for his two Ceylonese specimens (97.0-103.5 mm. S.L.). The highest counts in any other Indo-Pacific member of this group are those of *Sardinella fimbriata* (Valenciennes), for which Dutt (1959) gives a range of 40-72, and Chan (1959) a range of 69-81. *Sardinella fimbriata* has the exposed portions of the scales eroded, ridged and perforated, whereas this is not the case in the type of *Clupeonia jussieu*. The type of *Sardinella dayi*, on the other hand, does have perforated scales, and while this feature remains a "key" character, *Clupeonia jussieu* must remain distinct from *S. dayi*. A further reason for this is the rather deeper body found in *S. dayi*: 37.7 per cent. of S.L. in the holotype, 35.1-36.0 per cent. in Chan's two specimens; but only 29.8 per cent. in the type of *Clupeonia jussieu*. On the other hand, the two syntypes of *Alausa argyrochloris* (see p. 94), which resemble the type of *Clupeonia jussieu* in all other respects, have deeper bodies, as in *Sardinella dayi*. It can be mentioned also that Chan (*loc. cit.*) records alar scales on the caudal in his specimens of *S. dayi*, and these also occur in Regan's holotype. They are absent from the type of *Clupeonia jussieu*, although their accidental loss cannot be discounted.

Finally, there is one species in the *Clupeonia* group with a very high gillraker count, and this is the Mediterranean and West African *Sardinella maderensis* (Lowe). Ben-Tuvia (1959) gives a range of 70–166 gillrakers in fishes over 60 mm. S.L., increasing with size of fish. *Sardinella maderensis* has never been recorded from even the Red Sea, although it occurs in the Suez Canal (Whitehead, 1965a : 252). It is possible, however, that *Sardinella dayi* is this same species, or at least a member of the highly variable *maderensis-eba-granigera-cameronensis* group (which Ben-Tuvia, *loc. cit.*, recognized as a single species ; see p. 48). A characteristic feature in these fishes is the fimbriation and perforation of the scales, as is found in *Sardinella dayi* although not to the same extent. Again, the type of *Clupeonia jussieu* can be distinguished by its non-fimbriated scales.

Note. Valenciennes (1847 : 346, 351) chided Cuvier for attempting to resolve the “*jussieu*” problem without reference to specimens. Valenciennes himself speaks of Mauritian specimens which were quite definitely the species intended by Commerson in his description of the *Sardine de l’Ile de France*, but he lists only one such specimen, the present holotype. The latter resembles Lacepède’s variety of *Clupanodon jussieu* of plate 11, figure 3 in having a slightly darker fringe to dorsal and caudal fins (see Plate 3d). However, Valenciennes (footnote, p. 346) makes it clear that the figure referring to Lacepède’s *Clupanodon jussieu* is the latter’s plate 11, figure 2, i.e. that which is labelled “*Variété du CLUPANODON chinois*” (see Plate 3b). This latter figure is very inferior and, as suggested earlier (see p. 56), does not necessarily illustrate Lacepède’s species.

A complicating factor is that the figure of *Clupeonia jussieu* given by Valenciennes himself (shown here as Plate 4a), is clearly *Sardinella melanura*, i.e. the only fish in this genus with black caudal tips. But since there is an extant type specimen, the figure must take second place in the identification of the species. It is possible that the artist exaggerated the dusky caudal tips of the specimen.

If *Clupanodon jussieu* Lacepède is designated a *nomen dubium*, then *Clupeonia jussieu* Valenciennes will not be a secondary junior homonym, and this procedure is recommended here. Regan (1917b) placed *Clupeonia jussieu* in the synonymy of his *Harengula vittata* (Valenciennes), together with *Alausa melanura* Valenciennes. Bertin (1944), who had the opportunity of examining the types, criticized Regan’s action, counted “environ 70” gillrakers (95 recorded here), and claimed that *Clupeonia jussieu* was a member of *Sardinella* and identical to *Spratella fimbriata* Valenciennes, with *Clupanodon jussieu* Lacepède heading the synonymy. Fowler (1941) removed *Spratella fimbriata* from the synonymy of *Sardinella jussieu* (Lacepède). Such movements of names from one species or genus to the next and back have been a constant feature of clupeoid systematics, even when the author had access to type material.

As noted elsewhere (Whitehead, 1965a : 145), the two Quoy & Gaimard syntypes of *Alausa argyrochloris* Valenciennes from Mauritius (MNHN. 3753) are not *Hilsa toli*, as Bertin (1940) supposed, but a species of *Sardinella*. They were tentatively identified as *S. dayi* Regan. The following measurements were made.

S.L.	121.2	122.3 mm.	Scales : as in the holotype of <i>Clupeonia jussieu</i> ,
depth (% S.L.)	32.5	33.5	i.e. not perforated or eroded.
head l. (% S.L.)	24.7	25.3	
width in depth	2.54	2.57	
scutes	18 + 13	18 + 13	
gillrakers	84	98	

These specimens are evidently *Sardinella jussieu* in the sense recognized here, having unperforated and non-fimbriated scales. But in body depth they are much deeper than the type of *Clupeonia jussieu* and in this respect resemble *Sardinella dayi* (and thus *Sardinella maderensis*). For the present they are identified as *Sardinella jussieu* (Valenciennes).

31. *Clupea melanura* Cuvier, 1829
= *Sardinella melanura* (Cuvier, 1829)

Clupea melanura Cuvier, 1829, *Règne Animal*, 2 : 318 (footnote : "*Cl. melanura*, N., Lacep., V, xi, 3, sous le nom de *Clupanodon Jussieu*, mais la description se rapporte à la fig. xi, 3, nommée variété du *Clupanodon chinois*").

Alausa melanura Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 441 (New Guinea, Amboina, Vanikoro, Bourbon ; 18 fishes, up to 6 inches ; ? Quoy & Gaimard).

TYPE MATERIAL. There is no material now extant which could have formed the basis for either Lacepède's or Cuvier's description. In order to stabilize the complex situation surrounding the name *melanura* (see below), it is essential that a neotype be provided for Cuvier's species. The most suitable specimen is one of the Valenciennes specimens of *Clupeonia vittata* from Vanikoro ; this is described below as a putative neotype pending full revision. The justification for this choice is discussed later.

SPECIMENS (of *Alausa melanura* Valenciennes).

MNHN. 3233, 3 fishes, 91.1–98.2 mm. S.L., ex Vanikoro, coll. Quoy & Gaimard (assumed to be syntypes of *Clupeonia vittata*, see p. 66).

MNHN. B.2181, 2 fishes, 80.2–92.7 mm. S.L., ex New Guinea, coll. Quoy & Gaimard (formerly part of MNHN. 2207, transferred after re-identification).

Misidentified material (= *Herklotsichthys punctatus*).

MNHN. 3736, 2 fishes, 100.0–102.8 mm. S.L., ex Amboina, coll. Quoy & Gaimard.

MNHN. A.2207, 4 fishes, 80.2–100.5 mm. S.L., ex New Guinea, coll. Quoy & Gaimard.

All this material was listed by Bertin (1940) as the type material of *Alausa melanura*, and identified by him as *Harengula vittata*.

DESCRIPTION. *Putative neotype*, a fish of 93.2 mm. S.L., ex Vanikoro, coll. Quoy & Gaimard, in fair condition, scales now shed, with attached paper tag, one of three fishes, MNHN. 3233. This fish is lectotype of *Clupeonia vittata* (see p. 66).

(Specimen described on p. 66.)

IDENTIFICATION. The identification of this specimen is discussed on p. 68.

Note. Although *Clupea melanura* Cuvier was proposed merely on the basis of a poor Lacepède figure, the black caudal tips have proved sufficiently characteristic for authors to agree on the species intended. The specimen chosen here as putative

neotype agrees well with descriptions of *Sardinella melanura* (Cuvier) published by Regan (1917b), Fowler (1941) and Chan (1965). It can be said that the identity of Cuvier's species has not been in question, although the black caudal tips are rather faint in the Lacepède figure, at least in the copy in this museum (reproduced here, Plate 3d) ; the caudal tips are darker in the original Commerson drawing (Plate 3c here) from which the Lacepède figure was taken.

The main problem has been the question of the identity of a supposed second black-tipped species which Regan (1917b) and subsequent authors have all considered a member of *Harengula* (i.e. *Herklotsichthys*). Such authors have based this species on *Clupeonia vittata* Valenciennes, and have considered *Alausa melanura* Valenciennes a junior synonym (including Bertin (1940) who examined the types of *Alausa melanura*). The question has been complicated by the fact that, not only was *Clupea melanura* Cuvier without a type specimen (or adequate original description), but *Clupeonia vittata* has also hitherto been considered lacking type specimens, while the probable types have been attributed to *Alausa melanura*. Further, the types of *A. melanura*, as shown above, are mixed, and contain specimens of true *Herklotsichthys* (i.e. *H. punctatus*) as well as *Sardinella*.

In this way, a species of *Herklotsichthys* and a species of *Sardinella*, each apparently with black caudal tips, have appeared side by side in the literature and on museum shelves. One result was to upset attempts to clearly separate *Sardinella* from *Herklotsichthys*, since *H. vittatus* appeared to be intermediate (Whitehead, 1965b : 244). Another result was to propose yet another name to overcome the inevitable secondary homonymy as the name *melanura* became proliferated, e.g. *Clupea atricauda* of Günther, 1868, in the synonymy of which he placed *Harengula melanurus* Bleeker as well as *Clupeonia vittata* Valenciennes. It is interesting that, in his own *Clupea melanura*, Günther placed *Alausa melanura* Valenciennes, but without mention of *Clupea melanura* Cuvier. The solution adopted here, and discussed in more detail under *Clupeonia vittata*, is aimed at the recognition of a single black-tipped species which is identified as a member of *Sardinella*.

The presence of black caudal tips is a prominent feature in Valenciennes' descriptions of both *Clupeonia vittata* and *Alausa melanura*. The specimens of *Herklotsichthys punctatus* amongst the types of *A. melanura* do not have black caudal tips and obviously did not figure in Valenciennes' description of this species. This further disposes of the idea that one of Valenciennes' species was founded on a species of *Herklotsichthys*.

Lacepède based his *Clupanodon jussieu* on notes by Commerson, which the latter named "Grande Sardine de l'Île de France" and described as "*Halax harengus immaculatus maxilla inferiore longiore, pinna dorsali, radiorum sexdecim*". Lacepède also included in his genus *Clupanodon* the Linnaean species *Clupea sinensis*, which he referred to as *Clupanodon sinensis* or alternatively as *Le Clupanodon chinois*. Lacepède's plate 11 shows two clupeoids, labelled "2. Variété du CLUPANODON chinois" and "3. Variété du CLUPANODON Jussieu". There is no text reference to figure numbers. Cuvier concluded that figure 3 (which has dark dorsal and caudal tips), although labelled as a variety of "*jussieu*", merited the new name

Clupea melanura ; while figure 2 (with plain caudal tips) and labelled “ *chinois* ” belonged to Lacepède’s description of *C. jussieu*. (Unfortunately, Cuvier’s intentions are slightly obscured because he refers twice to figure 3, whereas the second reference must surely have been to figure 2—see synonymy above.)

Cuvier’s interpretation is not the only one possible. Figures and descriptions are poor, and it could be that Lacepède’s figures 2 and 3 are merely reversed, for black dorsal and caudal tips are described by Lacepède for his *Clupanodon sinensis*. The numbering of this plate runs 1, 3, 2 ; there are, however, other plates where the numbers do not run in sequence (plates 7, 8 and 10, for example). Again, the reason for using the term “ *variété* ” in the plate captions is not clear, for it does not occur in the text. The reason may have been that the figure did not definitely relate to the material described in the text, or was derived from another source.

When the two figures are compared (see Plate 3), the proximity of the pelvic and pectoral fin bases in figure 2 (*chinois*) are much more in accord with a shad (*Hilsa* species) than with a *Sardinella* ; the opposite is true of figure 3 (*jussieu*). On the other hand it is the “ *Clupanodon chinois* ” which is supposed to have the dorsal and caudal fins “ *bordées de brun ou de foncé* ”, not the reverse. Fin lengths, gauged from fin ray numbers, show a correspondence between text and figures, suggesting that the numbering of the figures is correct.

Obviously, the question could be argued indefinitely, and the best solution is to select the simplest of the possible hypotheses, particularly from a nomenclatural point of view. Since authors have, for over half a century, recognized a dark-tipped Cuvier species of *Sardinella* based on Lacepède’s plate 11, figure 3, and referred to it as *S. melanura* (Cuvier), there is no point in trying to alter this. Valenciennes (1847 : 346) criticized Cuvier for making too hasty a judgment without having original material at his disposal. But Valenciennes then proceeded to re-describe Lacepède’s *C. jussieu* on the basis of specimens of what appears to be a different species (i.e. close to *Sardinella dayi* Regan—see p. 60), giving his species the name *Clupeonia jussieu*, and only adding to the confusion. The question of whether Lacepède’s “ *Variété du CLUPANODON chinois* ” of figure 2 is his *Clupanodon sinensis* or his *Clupanodon jussieu*, is discussed under the latter species (p. 57).

32. *Clupeonia commersoni* Valenciennes, 1847
= *Sardinella melanura* (Cuvier, 1829)

Clupeonia commersoni Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 350 (coasts near Bombay ; three fishes ; Polydore Roux).

TYPE MATERIAL. MNHN. 2206, 2 fishes, 100–110 mm. S.L., *ex* Bombay, collected Roux.

MNHN. 2958, 1 fish, 99 mm. S.L., *ex* Bombay, coll. Roux.

All are in rather poor condition, with the snouts damaged. The fish tagged as 2206 is chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 100 mm. S.L., *ex* Bombay, coll. Roux, snout damaged, both jaws partially disarticulated, scales partly shed, MNHN. 2206.

Br.St. (n.r.), D iv 13, P i 13, V i 7, A ii 16 (or iii 15), g.r. 54 (51, 52 in paralectotypes), scutes 17 + 12, scales (indet.).

In percentages of standard length : body depth 29.1, head length 26.5 (approx.) ; snout length (damaged), eye diameter 6.5, upper jaw length 11.9, lower jaw length 12.8 (approx.) ; pectoral fin length 17.8, pelvic fin length 11.4, length of anal base 15.6 ; pre-dorsal distance 48.3, pre-pelvic distance 53.5, pre-anal distance 78.5.

Body moderately compressed, its depth a little greater than head length. Two supra-maxillae, the 2nd (posterior) with upper and lower portions about equal ; no hypo-maxillae.

Pseudobranch present, exposed, in length equal to eye diameter. Gillrakers fine and slender, $1\frac{1}{4}$ times length of corresponding gill filaments, $\frac{3}{4}$ of eye diameter. Fronto-parietal region with paired cuneiform areas bearing 8 longitudinal ridges.

Dorsal fin origin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral fin tips failing to reach pelvic base by $1\frac{1}{2}$ eye diameters. Pelvic fin base below 5th branched dorsal ray, equidistant between pectoral base and anal origin. Anal origin equidistant between pelvic and caudal bases.

Scales with 1 large and up to 6 finer vertical striae on unexposed portion, the latter always interrupted at centre of scale.

COLOUR : upper $\frac{1}{3}$ of body slate-coloured, rest of flanks silvery, or gold where scale cover retained. Caudal tips black.

IDENTIFICATION. The black caudal fin tips, moderate gillraker count and fairly slender body place this species in *Sardinella melanura* (Cuvier).

Note. Valenciennes named this species after Commerson and identified it with a Commerson drawing, chiefly because of the characteristic black caudal tips. It was this drawing (Plate 3c) that formed the basis of Lacepède's plate 11, figure 3, captioned *Variété du CLUPANODON Jussieu*. As explained earlier, it was this figure which Cuvier renamed *Clupea melanura*, a name which Valenciennes states he would have preserved had " the illustrious author of the Règne Animal " been more accurate and also dealt more fully with the " *jussieu* " element. In the event, Valenciennes adds yet another name to this figure—*commersoni*.

33. *Clupea otaitensis* Valenciennes, 1847 = *nomen nudum*

[*Clupea otaitensis*—MS name by Solander.]

Clupea otaitensis Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 351 (on *Clupea otaitensis* above, as synonym of *Clupeonia commersoni* Valenciennes).

TYPE MATERIAL. None.

IDENTIFICATION. Valenciennes immediately recognized this fish by the description of the caudal given by Solander " Pinnae caudae bifurca, apicibus loborum nigris ". This, and the general locality, strongly suggest *Sardinella melanura*. The name was published as a synonym and has not since been used as a senior synonym or the name of any other taxon. It is, therefore, a *nomen nudum* (International Code, Article 11 (d)).

34. *Clupeonia vittata* Valenciennes, 1847
 = *Sardinella melanura* (Cuvier, 1829)

Clupeonia vittata Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 352 (Vanikoro ; ? 1 fish of 5 inches ; Quoy & Gaimard).

TYPE MATERIAL. *MNHN*. 3233, 3 fishes, 91.1–98.2 mm. S.L., *ex* Vanikoro I., coll. Quoy & Gaimard.

These three fishes were included by Bertin (1940) in the type material for *Alausa melanura* Valenciennes, together with specimens from New Guinea and Amboina. Valenciennes gives Vanikoro alone for *C. vittata*, but New Guinea, Amboina, Vanikoro and Bourbon for *A. melanura*. The two species are separated by fifty pages of text, and it is possible that Valenciennes overlooked the fact that he had already listed a Vanikoro specimen under *C. vittata*. Bertin (*loc. cit.*) found no Valenciennes type material (from Vanikoro or any other locality) for *Clupeonia vittata*. Such a specimen (or specimens) may have been lost, or else Valenciennes repeated the same type locality for *Alausa melanura*. There is now no means of deciding which explanation is correct, but since a complex nomenclatural situation has arisen, it is in the best interests of nomenclature to propose a simple and effective answer.

The solution proposed here is to accept that the Vanikoro specimens are the true syntypes of *Clupeonia vittata*. This now prevents recognition of a Valenciennes species with black caudal tips as being a member of *Herklotsichthys* : the Vanikoro specimens are clearly *Sardinella*. If the Vanikoro *Clupeonia vittata* type(s) had been assumed lost, the possibility of a black-tipped *Herklotsichthys* would have remained, and it is precisely this black-tipped *Herklotsichthys* species (i.e. *H. vittatus*) which has so bedevilled the literature and systematics of the group. The largest Vanikoro specimen is just over 4 $\frac{3}{4}$ inches in total length, i.e. close to the 5 inches given by Valenciennes.

A second step in stabilizing the nomenclature is the designation of the lectotype of *Clupeonia vittata* as neotype (here putative neotype) of *Clupea melanura* Cuvier. Coupled with this is the recognition that *Alausa melanura* Valenciennes is the same species also. The result is a single black-tipped species, *Sardinella melanura* (Cuvier) (but see below, p. 68 for comments on *S. nigricaudata* Chan). As stated earlier, the specimen in question conforms to the concept of *S. melanura* (Cuvier) of authors.

DESCRIPTION. Based on the lectotype and two paralectotypes (figures in parentheses, largest fish first).

Lectotype, a fish of 98.2 mm. S.L., *ex* Vanikoro I., coll. Quoy & Gaimard, in fair condition, scales now shed, with attached paper tag, *MNHN*. 3233. (Also designated putative neotype of *Clupea melanura* Cuvier.)

Paralectotypes, two fishes, 91.1–93.2 mm. S.L., *ex* Vanikoro I., coll. Quoy & Gaimard, in fair condition, *MNHN*. 3233.

Br.St. 6 (6, 6), D iv 13 (v 12 or iv 13, iv 13), P i 13 (i 12, i 14), V i 7 (i 7, i 7), A iii 16 (ii 16, iii 16), g.r. 57 (56, 61), scutes 17 + 13 (17 + 13, 17 + 12), scales (shed).

In percentages of standard length : body depth 26.0 (26.7, 25.5), head length 26.0 (25.7, 26.7) ; snout length 7.4 (7.6, 7.8), eye diameter 7.6 (7.6, 7.6), length of

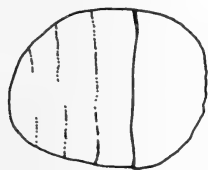
upper jaw 10.9 (10.5, 11.0), length of lower jaw 12.2 (12.2, 12.9); pectoral fin length 16.0 (damaged, 16.6), pelvic fin length 10.9 (9.4, 10.5), length of anal base 15.3 (14.2, 14.5), length of caudal fin 25.6 (23.6, 27.3); pre-dorsal distance 48.7 (46.5, 46.6), pre-pelvic distance 51.0 (53.5, 53.5), pre-anal distance 75.2 (79.0, 79.1).

Body compressed, its depth about equal to head length, belly keeled. Snout length about equal to eye diameter. Maxilla with smooth lower border; two supra-maxillae, the posterior with upper and lower parts of expanded portion about equal (Figure 5b); no hypo-maxillae. No teeth on pre-maxillae; 3-4 small conical teeth at dentary symphysis.

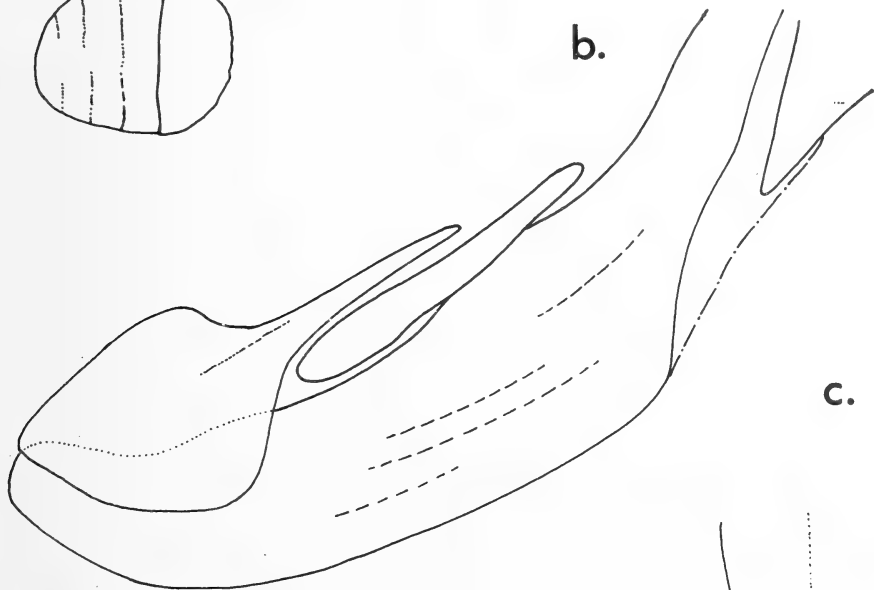
Pseudobranch present, exposed, its length $\frac{4}{5}$ of eye diameter. Gillrakers fine, slender, $1\frac{1}{4}$ times length of corresponding gill filaments, $\frac{3}{4}$ eye diameter. Fronto-parietal region with paired cuneiform areas bearing 7-8 longitudinal striae (Figure 5c).

Dorsal fin origin nearer to snout tip than to caudal base by just over 1 eye diameter. Pectoral fin tips failing to reach pelvic base by $1\frac{1}{2}$ eye diameters. Pelvic base below 4th branched dorsal ray, just nearer to pectoral base than to anal origin. Anal origin slightly nearer to caudal base than to pelvic base.

a.



b.



c.



FIG. 5. Scale, upper jaw and head sculpture in *Sardinella melanura* (Cuvier) based on putative neotype, 98.2 mm. S.L. (MNHN. 3233). a. Scale from below dorsal fin base. b. Right maxilla and supra-maxillae. c. Dorsal view of fronto-parietal region showing detail of striation on right side.

Scales with one large and 3 or more finer vertical striae, the latter interrupted in the centre of the scale ; striation pattern constant in all scaled areas (Figure 5a).

COLOUR : upper $\frac{1}{4}$ of body slate-coloured, flanks silver ; fins hyaline except caudal, which has black tips preceded by narrow whiteish band, the fin being grey in front of this (noted by Valenciennes ; see also his figure for *Clupeonia jussieu*—Plate 4a here).

IDENTIFICATION. As discussed above, the two Valenciennes species with black caudal tips, *Clupeonia vittata* and *Alausa melanura* have previously been placed respectively in *Harengula* (i.e. *Herklotsichthys*) and in *Sardinella*. The present specimens conform to the diagnosis of *Sardinella* given by Whitehead (1964c) in having 7–8 fronto-parietal striae arranged in typical “*Sardinella*” pattern, and a 2nd supra-maxilla of the *Sardinella* shape. In addition, the subsidiary vertical striae on the unexposed portions of the scales are interrupted as in *Sardinella*. The difference between the fronto-parietal striation patterns in *Sardinella* and *Herklotsichthys* is clearly shown in figs. 1a and b of Whitehead (1964a, c). (The figure for the latter was stated to have been drawn from one of the types of *Alausa melanura*. This is one of the specimens of *Herklotsichthys punctatus* which at that time was combined with the true *Sardinella* component of the type material. The figure for the “*Herklotsichthys*” shape of 2nd supra-maxilla (Whitehead, 1964c, figure 2a) is also taken from this specimen of *H. punctatus*.)

Sardinella melanura is a widespread and well-known Indo-Pacific species whose identification has rested chiefly on its black caudal tips. While it was possible to relegate black tipped specimens to *Herklotsichthys*, small meristic anomalies could remain undetected. Thus, Chan (1965 : 8) was able to state that “No one has ever reported more than 43 (gillrakers) on the lower limb” for *S. melanura*, while a range of 45–57 rakers was reported for Red Sea *Herklotsichthys vittatus* (Whitehead, 1965b). Combining these two nominal species, and recognizing an increase of rakers with size of fish (Whitehead 1965b : 248), it is now possible to question Chan’s *Sardinella nigricaudata*, which differed from *S. melanura* solely in having 68 gillrakers in a 99.5 mm. fish. Mr. Georg Losse of Zanzibar has sent me details of three Comoran specimens (99.8–105.3 mm. S.L.) with a gillraker range of 52–60, which suggests that Chan’s single specimen is merely an extreme variant.

35. *Sardinella leiogaster* Valenciennes, 1847
= *Sardinella leiogaster* Valenciennes, 1847

Sardinella leiogaster Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 270 (Indian Ocean and Trinque-malé ; fishes up to about 9 inches ; Hombron & Jacquinot, and also Regnault).

TYPE MATERIAL. MNHN. 3742, 1 fish, 198.0 mm. S.L., ex Indian Ocean, coll. Hombron & Jacquinot (*Astrolabe* and *Zélée*) (1840).

The Regnault material was not listed by Bertin (1940) and does not appear to be extant.

DESCRIPTION. *Holotype*, a fish of 198.0 mm. S.L., ex Indian Ocean, coll. Hombron & Jacquinot, in moderate condition, skin and scales missing anteriorly on both sides and along back, pectoral tips damaged, MNHN. 3742.

Br.St. 6, D iv 14, P i 16, V i 7, A iii 16, g.r. 33, scutes (? 2 +) 15 + 13, scales (indet.).

In percentages of standard length : body depth 21.7, head length 24.6 ; snout length 8.5, eye diameter 6.7, length of upper jaw 7.6, length of lower jaw 9.7 ; pectoral length 11.9 (tip damaged), pelvic length 8.3, length of anal fin base 11.7 ; pre-dorsal distance 52.0, pre-pelvic distance 52.6, pre-anal distance 80.9.

Body not strongly compressed, belly not strongly keeled, body depth a little less than head length. Snout length greater than eye diameter. Maxilla not reaching to vertical from anterior border of eye ; two supra-maxillae, the 2nd (posterior) approximating to the *S. aurita* shape, i.e. lower portion of expanded part deeper than upper, but profiles of both portions meeting the anterior shaft at about the same point (as in Figure 1a).

Pseudobranch present, exposed, about as long as eye diameter, filaments long, ventral base crescentic but not ridged and without groove below it (cf. *S. aurita* and *S. longiceps*). Gillrakers rather short, slender, longest rakers $\frac{7}{8}$ of corresponding gill filaments, $\frac{1}{2}$ eye diameter. Fronto-parietal region with paired cuneiform areas bearing 11–12 longitudinal striae. Teeth absent except for patch of minute teeth on tongue.

Dorsal fin origin nearer to caudal base than to snout tip by $\frac{1}{2}$ eye diameter. Pectoral (tips broken). Pelvic fin base below 1st branched dorsal ray, equidistant between pectoral base and anal origin. Anal fin origin nearer to caudal than to pelvic base by just over 1 eye diameter. Alar scales present.

COLOUR: upper $\frac{1}{3}$ slate-grey, remainder of flank silver (except where skin removed).

IDENTIFICATION. This specimen agrees with the description and keys given by Chan (1965) and Whitehead, *et alii* (1966).

Note. Regan (1917b) placed this species in the synonymy of *S. sirm* (Walbaum), as did Fowler (1941 : 616). Bertin (1940) first recognized *S. leiogaster* as distinct, but then (Bertin, 1944) believed it identical to Bleeker's *Amblygaster clupeoides*. As shown by Chan (1965) and Whitehead, *et alii* (1966), *S. sirm*, *S. leiogaster* and *S. clupeoides* are three distinct species.

The reference to *Elops javanicus* in the text by Valenciennes is here considered a mis-identification (see p. 15).

36. *Harengula abbreviata* Valenciennes, 1847 = *nomen dubium*

Harengula abbreviata Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 296 (Nouvelle-Hollande ; ? 1 fish, 8 inches ; J. Verseaux).

TYPE MATERIAL. No specimens listed by Bertin (1940) and none now present in Paris.

IDENTIFICATION. There is a specimen in Paris (MNHN. 4180) labelled "*Harengula abbreviata*. Australie. Musée de Sidney", but it is too deep bodied to be the type (depth $3\frac{1}{2}$ times in total length ; 5 and a bit times in description). Of the large, slender-bodied species of *Sardinella*, *S. aurita*, *S. leiogaster* and *S. sirm* are possible but these have rather smooth bellies ("Les dentelures du ventre sont assez

fortes" according to Valenciennes). There is no species of *Herklotsichthys* so slender, and *Sardinops* spp., as well as *S. sirm*, have a characteristic series of dark spots along the flanks.

The identity of this species must remain doubtful and the name should be dropped from the literature.

37. *Clupea coval* Cuvier, 1829
= *nomen dubium*

Clupea coval Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 318, footnote (on "Russ., 186" i.e. Russell's Kowal).

IDENTIFICATION. Cuvier merely validated the description and figure of Russell (1803) for the *Kowal* (reproduced here, Plate 5a), a perfectly valid procedure (Article 16 (a) of International Code) but one which can lead to difficulties if the original description is poor. The salient points in Russell's description are :

Body oblong-oval, compressed ; head small. Jaws nearly equal, lower covered by upper. No teeth in jaws, tongue smooth, palate not rough. Belly serrated. Gillrakers of 1st arch very long. Scales large, deciduous.

Colour : upper parts blue-green, flanks lighter, belly white ; dorsal and caudal greenish, the latter "striped black".

Br.St. 5, D 19, P 15, V 8, A 20, C 22.

Size : 4 inches, 4 lines (maximum $5\frac{1}{2}$ inches).

The description and drawing suggest either one of the deep-bodied species of *Sardinella* or else a young specimen of *Hilsa kelee*. The absence of a silver mid-lateral stripe rules out *Escualosa thoracata* and the body is too deep for a species of *Herklotsichthys*. However, in the deep-bodied *Sardinella* species (*S. brachysoma*, *S. jussieu*), as also in *Hilsa kelee*, the scales are mainly retained ; in the former, the fimbriated scales would certainly have been noticed, while in the latter the prominent black humeral spot and succeeding spots along the flanks would have appeared in the drawing. The dorsal is very far forward for either a species of *Sardinella* or *Hilsa*.

Elsewhere (Whitehead, 1964c : 40), Russell's *Kowal* has been compared with *Sardinella bulan* (Bleeker) (i.e. *S. albella*), a moderately deep species in which the scales are smooth edged but deciduous. It was concluded that the evidence implicating *S. bulan* was no stronger than that for any other species. The same conclusion is reached here : *Clupea coval* must be considered a *nomen dubium* which is unlikely to be redeemed in the future.

ESCUALOSA Whitley, 1940

[*Leptogaster* Bleeker, 1870, *Atlas Ichthyol. Ind. Néerland.*, 6 : pl. 262, fig. 5—Type : *Clupea* (*Leptogaster*) *argyrotaenia* Blkr. = *Kowala thoracata* Val.] (*nomen oblitum*).

Kowala : Regan, 1917, *Ann. Mag. nat. Hist.*, (9) 10 : 587 (Type : *Kowala thoracata* Val. designated by Regan, overlooking Gill's earlier designation of *K. albella* Val.) (*non Kowala Valenciennes*).

Escualosa Whitley, 1940, *Aust. Zool.*, 9 (4) : 402 (Type : *Clupea macrolepis* Steind. = *K. thoracata* Val.).

This synonymy is discussed in Whitehead (1964c) and Whitehead, *et alii* (1966).

The two Valenciennes nominal species identified here as *Escualosa thoracata* were placed in two genera (i.e. *Kowala* and *Meletta*) solely on supposed differences in dentition, even though the specimens bear a very great similarity to each other in general appearance. Both *Kowala* and *Meletta* were composite genera, the latter containing a selection of species from seven different clupeid genera (p. 20).

38. *Kowala thoracata* Valenciennes, 1847
= *Escualosa thoracata* (Valenciennes, 1847)

Kowala thoracata Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 363 (Pondichéry ; some specimens, 4 inches ; Bélanger).

TYPE MATERIAL. *MNHN*. 3172, 3 fishes, 80.8–95.5 mm. S.L., ex Pondicherry, coll. Bélanger.

From these, the largest has been chosen as lectotype, the remainder being paralectotypes.

DESCRIPTION. *Lectotype*, a fish of 95.5 mm. S.L., ex Pondicherry, coll. Bélanger, in rather poor condition, pectorals damaged, scales lost, *MNHN*. 3172.

Paralectotypes, two fishes, 80.8 and 89.5 mm. from the same lot, also in poor condition, paired fins damaged, *MNHN*. 3172. (Figures for paralectotypes in parentheses.)

Br.St. (n.r.), D iii 13 (n.r., iii 13), P i 11 (n.r., i 12), V i 6 (n.r., i 6), A iii 16 (n.r., iii 15), g.r. 33 (32, 32), scutes 18 + 11 (18 + 11, 18 + 12), scales (shed).

In percentages of standard length : body depth 32.8 (32.5, 31.7), head length 23.6 (22.5, 24.7) ; snout length 5.5 (5.1, 5.9), eye diameter 7.3 (7.3, 7.4), length of upper jaw 10.2 (10.0, 10.2), length of lower jaw 9.2 (9.1, 9.7), post-orbital distance 7.3 (7.4, 8.0), length of 1st supra-maxilla 1.7 (n.r., n.r.) ; pectoral fin length (damaged), pelvic fin length 9.5 (damaged in other two), length of anal base 15.2 (15.2, 15.5) ; pre-dorsal distance 47.9 (48.1, 49.5), pre-pelvic distance 52.5 (53.4, 51.5), pre-anal distance 76.5 (76.5, 76.0).

Body strongly compressed, belly strongly keeled, body depth greater than head length. Snout equal to eye diameter. Lower edge of maxilla smooth ; two supra-maxillae, the 1st (anterior) about $\frac{1}{3}$ length of expanded portion of 2nd (posterior) ; the latter with rectangular expanded portion, about twice as long as deep (Whitehead, 1964c, fig. 2) ; no hypo-maxillae.

Pseudobranch present, exposed, short, with 16 filaments. Gillrakers fine, slender. Fronto-parietal region with paired cuneiform areas bearing about 9 longitudinal striae. Gill opening without bilobed dermal expansions on vertical limb of cleithrum, and no cleithral lobe. Suboperculum triangular ; interoperculum triangular, deep posteriorly. Anterior frontal fontanelle open ; posterior frontal fontanelles closed.

Dorsal origin equidistant between snout tip and caudal base. Pectorals damaged. Pelvic base equidistant between pectoral base and anal origin. The latter nearer to caudal base than to pelvic base by $\frac{3}{4}$ pupil diameter.

COLOUR : upper $\frac{1}{3}$ of body greyish, a broad but faint midlateral silvery stripe ; remainder of flanks greyish ; fins hyaline.

Note. The present species was considered type of the genus *Kowala* by Regan (1917b), which he placed amongst the Pellonulinae. Gill (1861) had, however, designated *K. albella* Valenciennes type of *Kowala* (see p. 52), and reasons have been given elsewhere (Whitehead, 1964c) for not considering this species a member of the Pellonulinae (chiefly the presence of two supra-maxillae).

Valenciennes believed that this species was the *Kowal* or *Kowarloo* of Russell (1803, pl. 86). The latter, and Cuvier's name *Clupea coval* which was founded upon it, are here considered doubtfully identifiable (p. 70). Valenciennes also mentioned the *Clupea kowal* of Temminck & Schlegel, but the three specimens involved are *Sardinella albella* (Whitehead, 1964c, as *S. bulan*).

39. *Meletta lile* Valenciennes, 1847
= *Escualosa thoracata* (Valenciennes, 1847)

Meletta lile Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 378 (Pondichéry, also Coromandel ; some fishes, to 5 inches ; Leschenault, also Dussumier).

TYPE MATERIAL. MNHN. 3173, 2 fishes, 75.4–75.5 mm. S.L., ex Pondicherry, coll. Leschenault (1818).

MNHN. 3229, 10 fishes, 79.0–90.2 mm. S.L., ex Coromandel, coll. Dussumier.

The largest of the Pondicherry specimens is chosen as lectotype, the remainder being paralectotypes.

DESCRIPTION. *Lectotype*, a fish of 75.5 mm. S.L., ex Pondicherry, coll. Leschenault, in good condition, bearing paper registration tag, MNHN. 3173.

Br.St. 5, D iii 12, P i 11 (both sides), V i 6 (both sides), A iii 16, g.r. 28, scutes 18 + 11.

In percentages of standard length : body depth 33.4, head length 22.0 ; snout length 5.2, eye diameter 7.3, length of upper jaw 10.1, length of lower jaw 8.8 ; pectoral fin length 16.0, pelvic fin length 9.8, length of anal fin base 14.8 ; pre-dorsal distance 49.1, pre-pelvic distance 50.0, pre-anal distance 76.0.

Body deep, compressed, its width just over 3 times in its depth, belly sharply keeled, body depth greater than head length. Snout less than eye diameter. Maxilla with smooth lower border ; two supra-maxillae, the length of the 1st (anterior) contained $2\frac{1}{4}$ times in the length of the expanded portion of the 2nd (posterior) ; the latter twice as long as deep, subrectangular (Figure 6a).

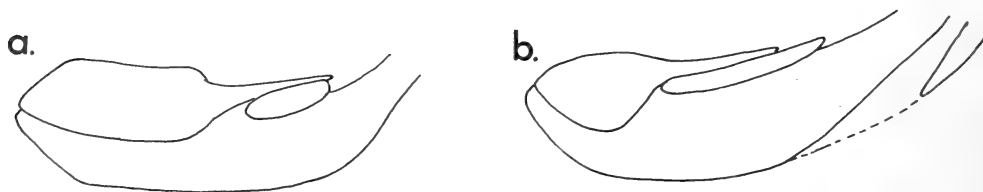


FIG. 6. Upper jaw (right side) showing shape of supra-maxillae. a. *Meletta lile* lectotype (= *Escualosa thoracata*), 75.5 mm. S.L. (MNHN. 3173). b. *Meletta thrissa* lectotype (= *Opisthonema oglinum*), 159.3 mm. S.L. (MNHN. 3690).

Pseudobranch present, exposed, its length $\frac{3}{4}$ of eye diameter. Gillrakers fine, slender, not quite equal to gill filaments in length, equal to $\frac{1}{2}$ eye diameter ; short gillrakers present on posterior face of 3rd epibranchial. Paired fronto-parietal cuneiform areas present, with 8 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral fins with no axillary scale. Pelvic base just before 1st unbranched dorsal ray, slightly nearer to pectoral base than to anal origin ; axillary scale present, $\frac{3}{4}$ length of fin. Anal origin slightly nearer to caudal base than to pelvic base ; base of fin enclosed in scaly sheath.

Scales with no striae, ridges, perforations or erosion on exposed portion ; unexposed portion with one large and 0-3 smaller vertical striae continuous across scale, the number of these striae increasing caudad.

COLOUR : upper $\frac{4}{5}$ of body brown, rest of flank and belly silver ; a faint silvery midlateral stripe, as wide as eye diameter. Fins hyaline except caudal with a faint dusky border (much more pronounced in the Coromandel specimens).

IDENTIFICATION. Valenciennes would certainly have recognized these specimens as *Kowala thoracata* had he not been hypnotized by supposed dentitional differences into placing them in another genus.

OPISTHONEMA Gill, 1861

Opisthonema Gill, 1861, *Proc. Acad. nat. Sci. Philad.*: 37 (Type : *Opisthonema thrissa* Gill by original designation = *Megalops oglina* LeSueur).

As noted by Myers (in Hildebrand, 1964), it is probable but not absolutely certain that Gill's *Opisthonema thrissa* was *Megalops oglina* Le Sueur, i.e. the modern *Opisthonema oglinum*. It seems likely that Gill, like Valenciennes and later Günther (1868), considered *Clupea thrissa* Linnaeus to include an American Atlantic as well as a Chinese species. *Opisthonema* is now recognized as being an entirely New World genus, while *Clupea thrissa* of Linnaeus is placed in Lacepède's Indo-Pacific genus *Clupanodon* (i.e. a gizzard shad, subfamily Dorosomatinae).

Valenciennes placed his specimens of *Opisthonema* in two species of different genera (*Meletta* and *Alausa*), but all his material belongs in the single American Atlantic species, *O. oglinum*. The species of *Opisthonema* have recently been reviewed by Berry & Barrett (1963).

40. ***Meletta thrissa* : Valenciennes, 1847**

= ***Opisthonema oglinum* (LeSueur, 1817)**

Megalops oglina LeSueur, 1817, *J. Acad. nat. Sci. Philad.*, **1** : 359 (Newport, Rhode I.)

Meletta thrissa Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 380 (New York, Saint Domingue, Guadeloupe, Martinique, Brésil ; many fishes ; collected respectively by Milbert, Ricord, l'Herminier, Plée & Achard, Delalande) (*non Clupea thrissa* Linnaeus).

VALENCIENNES MATERIAL. *MNHN*. 3690, 2 fishes, 143.5-159.3 mm. S.L., *ex* New York, coll. Milbert.

MNHN. 3691, 1 fish, 95.5 mm. S.L., *ex* Brazil, coll. Delalande.

MNHN. 3688, 1 fish, 167.0 mm. S.L., *ex* Martinique, coll. Achard.

MNHN. 3692, 3 fishes, 133.2–142.5 mm. S.L., ex Martinique, coll. Plée (1822).

MNHN. 3689, 6 fishes, 104.2–152.1 mm. S.L., ex Santo Domingo, coll. Ricord.

MNHN. A.3817, 1 fish, 121.9 mm. S.L., ex Guadeloupe, coll. l'Herminier.

As explained below, Valenciennes mistakenly assumed this species to be the *Clupea thrissa* of Linnaeus. A description is given here of a representative specimen.

DESCRIPTION. Based on a fish of 159.3 mm. S.L., ex New York, coll. Milbert, in fair condition, caudal tips complete, head cut horizontally on right side, scales lost anterior to dorsal fin, MNHN. 3690.

Br.St. 6, D iv 15, P i 15, V i 7, A iii 20, g.r. 97, scutes 18 + 16 (last minute), scales (indet.).

In percentages of standard length : body depth 35.5, body width 12.1, head length 26.6 ; snout length 7.0, eye diameter 6.7, length of upper jaw 10.0, length of lower jaw 10.9 ; pectoral fin length 20.8, pelvic fin length 10.9, length of anal fin base 17.2 ; pre-dorsal distance 46.9, pre-pelvic distance 53.5, pre-anal distance 79.0.

Body compressed, its width 3 times in its depth, belly keeled, body depth greater than head length. Snout a little greater than eye. Maxilla with smooth lower edge ; two supra-maxillae, the 1st (anterior) long and slender, the second (posterior) with lower part of expanded portion much larger than upper, the latter hardly rising above the line of the anterior shaft of the bone (Figure 6b).

Pseudobranch present, exposed, with ventral border ridged, its length $\frac{7}{8}$ of eye diameter. Gillrakers fine, slender, almost equal to gill filaments, equal to $\frac{1}{2}$ eye diameter ; epibranchial gillrakers of first arch not curled upwards, many gillrakers present on posterior face of third epibranchial ; mediopharyngobranchial present, bearing gillrakers. Gill opening with a pair of fleshy lobes on vertical face of cleithrum and a well-developed cleithral lobe. Fronto-parietal region with paired cuneiform areas bearing 7–10 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{1}{2}$ eye diameters ; last dorsal ray produced as filament, 39.2 per cent. of S.L., failing to reach caudal base when depressed by $\frac{1}{2}$ eye diameter. Pectoral fin tip reaching to vertical from 1st unbranched dorsal ray, failing to reach pelvic base by 1 eye diameter ; a groove present above 1st pectoral ray ; small axillary scale present, less than $\frac{1}{3}$ length of fin. Pelvic fin base slightly nearer to pectoral base than to anal origin, lying below 6th branched dorsal ray ; axillary scale present, $\frac{1}{3}$ length of fin. Anal fin origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ eye diameter.

COLOUR : upper $\frac{1}{3}$ slate-coloured, remainder of flanks silver, or gold where scale cover retained. Fins hyaline except for black caudal tips.

IDENTIFICATION. *Opisthonema oglinum* is the sole Atlantic species (Berry & Barrett, 1963) and authors have consistently placed *Meletta thrissa* in the synonymy of that species. Although *O. oglinum* has a range which spans 70° of latitude (New York to southern Brazil), Berry & Barrett (*loc. cit.*, fig 13) show a remarkably small variation in gillraker counts over this range.

Note. At the time of Valenciennes, considerable confusion existed over the species name *thrissa* (or *triza*) as applied to clupeid fishes with a filamentous last dorsal ray. A Chinese fish (*Clupanodon*) and three American Atlantic fishes (*Mega-*

lops, *Dorosoma* and *Opisthonema*) were involved. In his descriptions of the Chinese clupeid fishes *Mystus altus* and *Clupea triza*, Linnaeus (1754 and 1759) did not mention the filamentous ray, but the latter appears in the *Systema Naturae* (1758) for *Clupea thrissa*, presumably on the description of *Clupea thrissa* by Osbeck (1757, "quorum ultimo duplo longior"). Unfortunately, Linnaeus (1758) included not only the Osbeck reference and his Lagerström description in the synonymy of *Clupea thrissa*, but also the Jamaican *Clupea minor*, *radio ultimo pinnae dorsalis longissimo* of Brown (1756 : 443).

Valenciennes, Günther (1868 : 432), Gill (1861) and other authors up to but not including Regan (1917b), seem to have assumed the Atlantic and Chinese species to be the same. Valenciennes is not explicit on this point, since he does not give a synonymy as such, but he implies that LeSueur's *Megalops oglina* and *M. notata* are junior synonyms of his own *Meletta thrissa*. Regan (*loc. cit.*) finally restricted the name *thrissa* to a Chinese and not an American species, and correctly so, since it was originally based on Chinese material. Because of this confusion, coupled with Valenciennes' habit of placing "nob." after both new species and new generic allocations, it is not always clear from synonymies that *Meletta thrissa* Valenciennes is not a new name, but the misapplication of an old one.

Lacepède (1803 : 470) included the Plumier MS name *Halex festucosus* in his synonymy of *Clupanodon thrissa*. The drawing (shown here, Plate 5c) and the locality (West Indies) show this fish to have been *Opisthonema oglinum*.

41. *Alausa striata* Valenciennes, 1847

= *Opisthonema oglinum* (LeSueur, 1817)

Alausa striata Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 429 (Guadeloupe ; 2 fishes, 9 inches ; Ricord : also some Bahia specimens donated Geneva Museum).

TYPE MATERIAL. MNHN. 3938, 2 fishes, 152.0–186.0 mm. S.L., ex Guadeloupe, coll. Ricord (DRY SPECIMENS).

MNHN. 3735, 2 fishes, 143.5–162.3 mm. S.L., ex Bahia, donated Geneva Museum (in alcohol).

The smaller of the two Bahia specimens is suitable for lectotype designation ; the larger has a damaged head and the right pectoral tip is broken. The two dried specimens both lack the filamentous last dorsal ray. They were not included by Bertin (1940: 289) but are part of the syntypical series.

DESCRIPTION. *Lectotype*, a fish of 143.5 mm. S.L., ex Bahia, donated Geneva Museum, in good condition, scales retained, bearing paper registration tag, MNHN. 3735.

Br.St. 6, D iv 15, P i 15, V i 7, A iii 21, g.r. 78 (72 in second fish), scutes 19 + 16 (last minute), scales (n.r.).

In percentages of standard length : body depth 33.3 (32.3 in second fish), body width 10.3, head length 24.5 ; snout length 6.2, eye diameter 6.8, upper jaw length 9.9, lower jaw length 10.6 ; pectoral fin length 18.8, pelvic fin length 10.4, length of anal base 17.9 ; pre-dorsal distance 45.8, pre-pelvic distance 52.0, pre-anal distance 77.0.

Body compressed, its width about 3 times in its depth, belly keeled, body depth greater than head length. Snout a little shorter than eye diameter. Jaw exactly as in lectotype of *Meletta thrissa* (Figure 6b).

Pseudobranch present, exposed, its length equal to eye diameter, its ventral border ridged anteriorly and with slight groove below it. Gillrakers fine, slender, almost equal in length to gill filaments, just over $\frac{1}{2}$ eye diameter; mediopharyngobranchial present, long, bearing gillrakers. Gill opening with two dermal lobes on vertical face of cleithrum and a well-developed cleithral lobe. Fronto-parietal region with paired cuneiform areas bearing about 10 longitudinal striae.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{3}{4}$ eye diameters; last dorsal ray filamentous, 27.8 per cent. of S.L. Pectoral fin tip not quite reaching to vertical from 1st unbranched dorsal ray, failing to reach pelvic base by just over 1 eye diameter; groove present above 1st pectoral ray. Pelvic fin base below 7th branched dorsal ray, just nearer to pectoral base than to anal origin; axillary scale not found. Anal fin origin equidistant between caudal base and pelvic base.

Scales with unexposed portion bearing one large and 0-5 smaller vertical striae, the latter interrupted at centre of scale.

COLOUR: upper $\frac{1}{3}$ slate-coloured, remainder of flanks silver, or gold where scale cover retained. Fins hyaline (caudal tips also plain).

IDENTIFICATION. A filamentous last dorsal ray was evidently present in both the two dried specimens but has subsequently broken off. All four specimens are clearly Atlantic *Opisthonema* i.e. *O. oglinum*, but the name *Alausa striata* has had a varied history. Günther (1868: 413) placed it as the last of 26 dubious species of *Clupea*, Jordan & Evermann (1896: 431) synonymized it with their *Sardinella humeralis* (Val.), and Regan (1917b: 388) identified it with *Harengula macrophthalmia*. Storey (1938: 51) seems to have been misled by some personal notes by Chabanaud, who reported only 39 gillrakers in the larger of the two Bahia specimens and sent what was obviously a very anterior scale which had none of the finer, interrupted vertical striae on it.

Valenciennes' description is chiefly concerned with comparing the species with *Alausa eba* and *Alausa dorsalis*, and with emphasizing the main vertical scale striation; he does not mention the filamentous last dorsal ray. To add to subsequent doubts, Valenciennes ended by saying that the species is perhaps the *Clupea arcuata* of Jenyns, a statement which was neither accurate nor helpful to subsequent workers. Bertin (1940 and 1944) correctly identified the types.

Subfamily ALOSINAE

In the second edition of the *Règne Animal* (1829), Cuvier at last separated the shads from the true herrings on their possession of a distinct notch in the upper jaw, noting that in other respects they resembled 'pilchards and sardines'. Regan (1916: 6) also emphasized this jaw character (which had been ignored by Günther, 1868), and this feature is still the sole diagnostic character of the shads, even though the notched condition is approached by certain members of the Clupeinae (some *Sardinella* for example).

As might be expected, Valenciennes dismissed the notched jaw character in favour of his dentitional system, and while correctly remarking on the presence of notched upper jaws in non-shad-like fishes, he proceeded to distribute the true shads among a range of non-shad-like genera (*Clupea*, *Harengula*, *Clupeonia*, *Meletta*—see Tables 3 and 4).

ALAUSA Valenciennes, 1847

= **ALOSA** Linck, 1790

Alosa Linck, 1790, *Mag. Physik. Natuurg. Gotha*, **6** (3) : 35 (Type : not specified) ; Cuvier, 1829, *Règne Anim.*, 2nd ed., **2** : 319 (Type : *Clupea alosa* Linnaeus).

Alosa Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 389 (Type : *Alosa vulgaris* Val. = *Clupea alosa* Lin.) (apparently merely a variant spelling of *Alosa*).

Valenciennes regarded his genus *Alosa* as the culmination, and in a sense the justification, of his generic system built on dentition; here were fishes with no teeth at all in the mouth and jaws. He modestly acknowledged that DeKay (1842) had made this same division, but pointed out that some of the latter's shads have teeth on the tongue. Within the genus *Alosa* (*sensu* Svetovidov, 1964) the two European species *A. alosa* and *A. fallax* are unusual in being edentulous. This is not the case in most of the Caspian species nor in the American species studied by DeKay. Valenciennes noted the resemblance between his shads and the true herrings but curiously denied that the swim-bladder has anterior extensions entering and forming vesicles within the skull. This is incorrect, the shads having exactly the same intracranial vesicles (pro-otic and pterotic) as in most other clupeids (Svetovidov, 1963 : 233) ; the two "ligaments" described by Valenciennes as leading forward from the swim-bladder are the usual paired anterior extensions of the swim-bladder.

By accepting the absence of teeth as the main feature characterizing *Alosa*, Valenciennes excluded many true *Alosa* but included a very wide range of fishes now placed in no less than ten genera (*Alosa*, *Sardinella*, *Ethmidium*, *Sardinops*, *Hilsa*, *Gudusia*, *Ethmalosa*, *Brevoortia*, *Opisthonema* and *Sardina*).

In his synonymy of *Clupea alosa*, Lacepède (1803 : 448) included a Plumier name, *Trichis Bellonii*, La Pucelle. Jordan (1917 : 73) listed *Trichis* as a possible generic name, but believed it wrongly identified by Lacepède. The Plumier drawing (in the Bibliothèque Centrale, MS 25, folio 32) shows a species of *Alosa* with a large humeral spot and four other black spots along the flank, suggestive of *Alosa fallax*. However, the species represented is presumably from the Western North Atlantic (i.e. from Martinique), and while *Alosa sapidissima*, *A. mediocris* and *A. aestivalis* have one or more black spots on the flanks, none of them is recorded from south of Florida (Hildebrand, 1964). The pre-dorsal scales are normal, thus ruling out a species of *Brevoortia*. *Trichis* is almost certainly a junior synonym of *Alosa*. It has not been used as a senior synonym and there is no advantage in resurrecting it ; under Article 11 (d) of the International Code, the name is unavailable since it has not been adopted as the name of a taxon and has not been used as a senior synonym.

42. *Alosa vulgaris* Valenciennes, 1847
= *Alosa alosa* (Linnaeus, 1758)

Alosa vulgaris Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 391 (Dieppe, Havre, Abbeville and numerous other localities, including the Mediterranean ; no indication of size of described fish).

TYPE MATERIAL. *MNHN*. 3676, 1 fish, 390 mm. S.L., *ex* Paris Market, presented by Valenciennes.

MNHN. 5434, 1 fish, 415 mm. S.L., *ex* Seine, coll. Valenciennes.

MNHN. 3133, 1 fish, 151.1 mm. S.L., *ex* Algeria, coll. Guichenot (1840).

MNHN. 3398, 1 fish, 76.7 mm. S.L., *ex* Seine, coll. Valenciennes (misidentified as *A. fallax* by Bertin, 1940).

The specimen from the Paris Market is in fair condition and is chosen here as lectotype, the remainder being paralectotypes.

DESCRIPTION. *Lectotype*, a fish of 390 mm. S.L., *ex* Paris Market (presumably caught in Seine), presented by Valenciennes, some posterior scales missing but otherwise in fair condition, *MNHN*. 3676.

Br.St. 7 (both sides), D v 16, P i 15, V i 8, A iii 22, g.r. 69, scutes 21 + 16, scales (n.r.).

In percentages of standard length : body depth 31.2, head length 23.8, height of head at occiput 17.9 ; width of snout (between nostrils) 4.3, length of snout 5.3, eye diameter 4.7, length of upper jaw 11.8, length of lower jaw 13.5 ; longest gill-raker on 1st arch 6.3, longest filament of posterior hemibranch 4.6 ; pectoral fin length 15.1, pelvic fin length 9.4, length of anal fin base 18.3 ; pre-dorsal distance 46.1, pre-pelvic distance 49.2, pre-anal distance 72.0.

Body moderately compressed, deeper than head length. Snout a little longer than eye diameter ; head not markedly wedge-shaped or compressed ventrally. Upper jaw notched. Maxilla long, ventral edge smooth ; two supra-maxillae, the 2nd (posterior) with upper and lower parts of expanded portion about equal, the whole bone rounded posteriorly ; the 1st (anterior) supra-maxilla a little longer than expanded portion of second. Lower jaw projecting.

Pseudobranch present, exposed, attenuated, with no ridge or groove along ventral edge, its length equal to $1\frac{1}{4}$ eye diameters. Gillrakers slender, $1\frac{1}{3}$ times length of corresponding gill filaments, $1\frac{1}{3}$ times eye diameter. Operculum striated.

Dorsal fin origin nearer to snout tip than to caudal base by $2\frac{1}{2}$ eye diameters. Pectoral fin tips failing to reach pelvic base by $2\frac{1}{2}$ eye diameters ; a groove present above first pectoral ray. Pelvic fin base below 2nd branched dorsal ray, equidistant between pectoral base and anal origin ; an axillary scale present, half length of fin. Anal origin nearer to pelvic base than to caudal base by $\frac{3}{4}$ eye diameter.

COLOUR : upper $\frac{1}{3}$ of body brownish, flanks silver, or gold where scale cover retained. No sign of spots on flanks.

IDENTIFICATION. This specimen, as well as the other three listed as paralectotypes, can be clearly identified as *Alosa alosa* by the longer and more numerous gillrakers as compared to *A. fallax* (Svetovidov, 1963, key, p. 247).

Note. Valenciennes rejected earlier attempts to separate *A. fallax* from *A. alosa*, and instead combined them under the single name *Alausa vulgaris*. There are more specimens of *A. fallax* than *A. alosa* in Paris and the preponderance of the former might suggest that Valenciennes had the Twaite Shad in mind when he described *Alausa vulgaris*. The description offers only a negative clue : no series of black spots along the flanks is mentioned. I have therefore assumed that Valenciennes based his actual description on a specimen of *A. alosa*.

The first author to distinguish *A. alosa* from *A. fallax* by the difference in gill-rakers was Troschel (1852). Noting this, Günther (1868 : 434) pointed out that *Clupea alosa* Linnaeus was based on Artedi's description of a shad with "apophyses in parte concava osseae, albae et satis robustae", the last two words strongly suggesting that Artedi had in mind the species with thick gillrakers, i.e. *A. fallax*. The name *alosa* should, therefore, apply to the present *A. fallax*. But since the two species were evidently confounded in the synonymies of both Artedi and Linnaeus, and since the present name *Alosa alosa* is universally accepted for the Allis Shad, there is no point in altering the nomenclature.

The following specimens of *Alosa fallax* appear to have been part of Valenciennes' *Alausa vulgaris* material.

Alosa fallax fallax.

MNHN. 3163, 1 fish, 128.6 mm. S.L., ex Le Havre, coll. Valenciennes.

MNHN. 3396, 1 fish, 125.7 mm. S.L., ex Dieppe, coll. Valenciennes.

MNHN. 3397, 3 fishes, 71.7–99.9 mm. S.L., ex La Rochelle, coll. d'Orbigny.

MNHN. 3752, 1 fish, 210.0 mm. S.L., ex Gulf of Genoa, coll. Hollard.

MNHN. 6263, 1 fish, 242.0 mm. S.L., ex Bosphorus, coll. Birlet.

MNHN. 3134, 2 fishes, 141.5–141.6 mm. S.L., ex Algiers, coll. Guichenot. (g.r. 14 + 27, short and thick).

Alosa fallax var. *lacustris*.

MNHN. 3682, 3 fishes, 160–200 mm. S.L., ex Lake Como, coll. Ricketts & Pentland (g.r. 18 + 36).

MNHN. 3683, 2 fishes, 145–160 mm. S.L., ex Lake Guard, coll. Bosc.

MNHN. 3750, 1 fish, 340 mm. S.L., ex Lake Major, coll. Mayor (g.r. 13 + 1 + 24).

43. *Clupea fallax* Lacepède, 1803

= *Alosa fallax* (Lacepède, 1803)

Clupea fallax Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 452 (Seine, on notes by Noel de la Morinière, no specimens mentioned).

TYPE MATERIAL. MNHN. 3188, 1 fish, 380 mm. S.L., ex Seine at Rouen, coll. ? Ficeali.

According to Bertin (1940), this specimen was actually sent to Lacepède, although it is not cited by him. Since it comes from the type locality, it would be suitable for designation as neotype.

DESCRIPTION. *Putative neotype*, a fish of 380 mm. S.L. (475 mm. tot.l.), ex River Seine, coll. ? Ficeali, in fair condition, belly formerly slit, now sewn up, scales of belly and right flank lost, caudal tips intact, MNHN. 3188.

Br.St. (n.r.), D v 15, P i 15, V i 8, A iii 18, g.r. 25, scutes 20 + 16, scales (n.r.).

In percentages of standard length : body depth 24.6, head length 23.7, depth of head at occiput 17.7 ; snout length 5.5, distance between nostrils 4.2, eye diameter 4.7, length of upper jaw 11.3, length of lower jaw 12.7 ; longest gillraker on 1st arch 3.76, length of corresponding gill filaments 3.47 (anterior hemibranch) and 4.35 (posterior) ; pectoral fin length 15.1, pelvic fin length 9.7, length of anal fin base 16.4 ; pre-dorsal distance 48.6, pre-pelvic distance 47.3, pre-anal distance 74.0.

Body moderately compressed, belly keeled, body depth a little less than head length. Snout a little greater than eye diameter. Maxilla with fine denticulations along lower edge ; two supra-maxillae present, 1st (anterior) long and narrow, 2nd (posterior) with lower part of expanded portion much larger than upper, the latter barely rising above the general line of the anterior extension of the bone (Figure 7a).

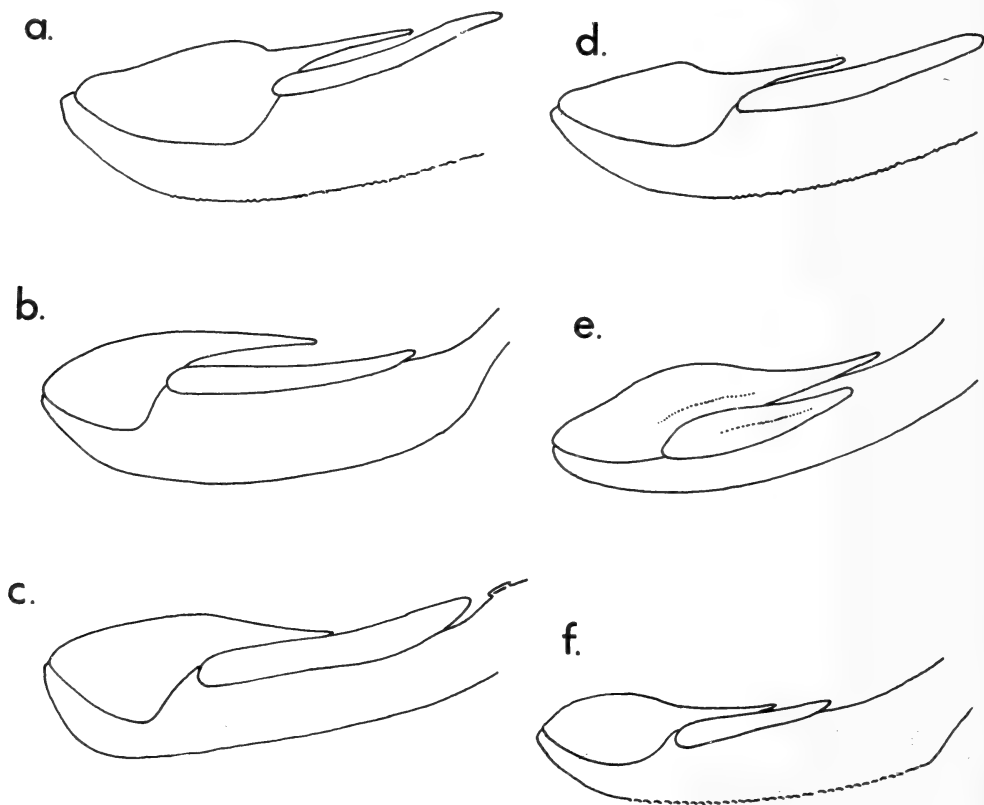


FIG. 7. Upper jaw (right side) showing shape of supra-maxillae. a. *Chupea fallax* putative neotype (= *Alosa fallax*), 380 mm. S.L. (MNHN. 3188). b. *Alausa dorsalis* lectotype (= *Ethmalosa fimbriata*), 159.5 mm. S.L. (MNHN. 3175). c. *Alausa microlepis* lectotype (= *Gudusia chapra*), 145.7 mm. S.L. (MNHN. 3696). d. *Meletta suoerii* lectotype (= *Alosa alabamiae*), 68.6 mm. S.L. (MNHN. 3695). e. *Alausa maculata* holotype (= *Ethmidium maculatum*), 238 mm. S.L. (MNHN. 1890). f. *Meletta venosa* lectotype (= *Alosa pseudoharengus*), 117.5 mm. S.L. (MNHN. A.7641).

Pseudobranch present, exposed and long, $1\frac{1}{4}$ times eye diameter, ventral border not ridged and without groove below it. Gillrakers short and rather blunt, a little shorter than corresponding filaments of posterior hemibranch, a little less than eye diameter. Operculum striated; line of lower edge of operculum rising steeply, meeting dorsal profile just before dorsal fin origin if projected.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{1}{4}$ eye diameters. Pectoral fin tips failing to reach pelvic base by $1\frac{1}{3}$ eye diameters. Pelvic fin base below 1st unbranched dorsal ray, nearer to pectoral base than to anal origin by just over $\frac{1}{2}$ eye diameter; axillary scale present, $\frac{1}{2}$ length of fin. Anal fin origin nearer to pelvic base than to caudal base by $\frac{1}{2}$ pupil diameter; alar scales present, and also small scales along first half of caudal lobes.

COLOUR: upper $\frac{1}{3}$ brownish, rest of flanks silvery, or gold where scale cover retained; no vestige of spots on flank.

IDENTIFICATION. The short, rather few gillrakers, which are about equal in length to the gill filaments, the rather pointed snout and the head little compressed ventrally, place this specimen in *Alosa fallax* (fide Svetovidov, 1963, key p. 247). According to Svetovidov (*loc. cit.*), *A. fallax fallax* is distinguished from *A. fallax nilotica* both by its lower gillraker count (total 37-43; cf. 34-37) and by its more anteriorly placed dorsal origin. The present specimen agrees with *A. f. fallax* in gillraker count but has the dorsal origin set rather further back, i.e. pre-dorsal distance 48.6 per cent. of S.L. (average fide Svetovidov, 43.5 in *A. f. fallax* and 45.0 in *A. f. nilotica*). This discrepancy is not considered a serious objection to the identification of this specimen as *A. f. fallax*; the higher gillraker count and locality rule out *A. f. nilotica*.

While Regan (1917) and other authors used the name *Alosa finta* (Cuvier), most modern authors have recognized the priority of Lacepède's name *fallax* for the Twaite Shad. There is, however, an earlier name, *Alosa ficta*, ascribed to Duhamel (1772), which has recently been revived by Spillman (1961). Svetovidov (1966) has applied to the International Commission to reject the name *Alosa ficta* because Duhamel's *Traité général des Pêches* . . . was not strictly binominal.

44. *Clupea rufa* Lacepède, 1803
= *Alosa fallax* (Lacepède, 1803)

Clupea rufa Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 452 (Seine; on notes by Noel de la Morinière, no specimens mentioned).

TYPE MATERIAL. There are no specimens in Paris that could have been examined by Lacepède, except for the single specimen of *A. fallax* here proposed as putative neotype.

IDENTIFICATION. Günther (1868 : 433) placed *Clupea rufa* in the synonymy of *Clupea alosa*; Regan (1916) ignored the name. But since Lacepède clearly stated that a series of black or brown spots is present along the flanks, it seems more likely that he had *Alosa fallax* in mind. He coupled his description with that of the *Feinte* (i.e. *A. fallax*) and relied mainly on Noel de la Marinière for field notes. The latter apparently noted that the fishermen recognized two forms, a small spring form

with large scales, and a smaller-scaled form caught in Thermidor and Fructidor (i.e. late July to late September). Both had spots on the flanks. Since *A. alosa* and *A. fallax* cannot be separated on scale characters, it is possible that the fishermen had yet another clupeid present. But Lacepède's inability to separate his *Rousse* (*Clupea rufa*) from his *Feinte* (*Clupea fallax*) in his synopsis of species strongly suggests that the *Rousse* is better combined with the *Feinte* than with the *Alose* (*Alosa alosa*).

45. *Clupea finta* Cuvier, 1829
= *Alosa fallax* (Lacepède, 1803)

Clupea finta Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 320 (no type ; southwards to Nile ; on the *Venthe*, *Agone*, *Lachia* and *Alachia*).

TYPE MATERIAL. Cuvier does not, of course, mention specimens, but the probable type of *Clupea fallax* Lacepède at least was almost certainly available to him. He had earlier (Cuvier, 1817) listed only *Clupea alosa*, stating that the *Feinte* and the *Rousse* of the Channel, and the *Alachie* of the Mediterranean, had not yet been sufficiently compared with the true *Alose*, but he evidently decided later to recognize the two species of shad.

IDENTIFICATION. Cuvier distinguished his *A. finta* from *A. alosa* by its more elongate body, teeth in both jaws, and presence of 5 to 6 black marks along the flanks. Only the last of these is of diagnostic value, but Cuvier was evidently referring to the Twaite shad (*A. fallax*). *Alosa fallax* is found in the Eastern Mediterranean whereas *A. alosa* is not ; "On la (i.e. *A. finta*) retrouve jusque dans le Nil" according to Cuvier.

Note. Günther (1868 : 435), Regan (1916) and many modern authors have ignored Lacepède's *Clupea fallax* and used Cuvier's name *A. finta*, but this is incorrect. Cuvier himself ignored Lacepède's name *fallax* and cites "*Cl. ficta* Lac." in his synonymy. This name has already been discussed (p. 81).

46. *Meletta venosa* Valenciennes, 1847
= *Alosa pseudoharengus* (Wilson, ca 1811)

Clupea pseudoharengus Wilson, ca 1811, in Rees' *New Cyclopaedia* (Art. *Clupea*), 9 (undated) : no pagination (no local., prob. Philadelphia).

Meletta venosa Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 374 (New York ; some fishes, to 5½ inches ; Milbert).

TYPE MATERIAL. MNHN. A.7641, 3 fishes, 107.5–113.0 and 117.5 mm. S.L., ex New York, coll. Milbert.

The largest of these syntypes has been chosen of lectotype.

DESCRIPTION. *Lectotype*, a fish of 117.5 mm. S.L., ex New York, coll. Milbert, scales missing but otherwise in good condition, bearing paper tag, MNHN. A.7641.

Br.St. 7, D iv 13, P i 15, V i 8, A iii 15, g.r. 23 + 44, scutes 19 + 14.

In percentages of standard length : body depth 29.8, body width 10.1, head length 26.7 ; snout length 6.2, eye diameter 8.6, length of upper jaw 13.0, length of lower jaw 15.2, height of lower jaw 6.55 ; pectoral fin length 20.7, pelvic fin length 14.0, length of anal fin base 16.3 ; pre-dorsal distance 48.8, pre-pelvic distance 51.3, pre-anal distance 77.0.

Body compressed, its width 3 times in its depth, belly sharply keeled, head shorter than body depth. Lower jaw projecting but not cutting dorsal outline of head ; height of lower jaw 2.32 times in its length, the highest point being in front of midpoint in length of jaw ; no teeth at dentary symphysis. Upper jaw with moderate median notch ; a few minute teeth on pre-maxillae ; maxilla reaching to vertical from posterior border to pupil, a few minute denticulations on lower edge ; two supra-maxillae (Figure 7f), the 1st (anterior) about 5 times as long as deep, the 2nd (posterior) similar in shape to that of *Harengula* ; expanded portion of maxilla with two prominent longitudinal ridges.

Frontals with a ridge on each side from nostrils to occiput, diverging behind eye and then converging but not meeting ; a pair of shorter ridges between the outer ones, beginning over eye centre and diverging posteriorly ; 2-3 short longitudinal ridges forming cuneiform fronto-parietal area.

Pseudobranch present, exposed, its length about $\frac{3}{4}$ eye diameter. Gillrakers moderately slender, those on epibranchial of 1st arch folding over those of ceratobranchial at angle of arch ; longest rakers $1\frac{1}{4}$ times length of corresponding gill filaments, $\frac{2}{3}$ eye diameter ; mediopharyngobranchial present, short, with about 5 gillrakers on it ; 11 short, stumpy gillrakers on posterior face of 3rd epibranchial. Cleithral lobe present, but no biloped dermal appendages on vertical face of cleithrum. Operculum with two vertical ridges near anterior margin of bone ; lower edge of operculum rising steeply.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{2}{3}$ eye diameter. Pectoral fin tips very slightly damaged, but estimated to fail to reach pelvic fin base by 1 eye diameter ; no groove or axillary scale above 1st pectoral ray. Pelvic fin origin below vertical from 3rd branched dorsal ray, equidistant between pectoral base and anal origin ; axillary scale present, $\frac{1}{3}$ length of fin. Anal origin equidistant between pelvic base and caudal base.

COLOUR : upper $\frac{1}{4}$ of body brown, remainder of flanks silver, boundary between two sharp. Fins hyaline except for dark pigmentation at tips of anterior dorsal rays.

IDENTIFICATION. Hildebrand (1964) separated *Pomolobus pseudoharengus* from *P. aestivalis* (Mitchill, 1814) principally on the relative proportions of the snout and eye, the eye being larger than snout length in the former. This is the case in the present lectotype. Hildebrand (*loc. cit.*) recorded a higher range of gillrakers in *P. aestivalis* (41-52 ; cf. 38-44), so that the present lectotype lies only just within the range for *P. pseudoharengus*. The two species are evidently very similar and occupy almost the same range, i.e. Nova Scotia southwards to North Carolina (*pseudoharengus*), or to Florida (*aestivalis*). Future studies may perhaps combine the two species.

47. *Meletta suoerii* Valenciennes, 1847
= *Alosa alabamæ* Jordan & Evermann, 1896

Meletta suoerii Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 375 (Wabash R. ; some fishes, 3 inches and a few lines ; LeSueur) (*nomen oblitum*).

Alosa alabamæ Jordan & Evermann, 1896, in Evermann, *Rep. U.S. Comm. Fish.* (1895), **21** : 203 (Black Warrior R., Tuscaloosa, Alabama).

TYPE MATERIAL. *MNHN*. 3695, 2 fishes, 63.7–68.6 mm. S.L., *ex* Wabash River (Illinois), coll. LeSueur (1830).

The larger of the two syntypes has been selected here as lectotype.

DESCRIPTION. *Lectotype*, a fish of 68.6 mm. S.L., *ex* Wabash River, coll. LeSueur, in good condition, *MNHN*. 3695.

Br.St. (n.r.), D iv 15, P i 16, V i 8, A iii 18, g.r. 33, scutes 21 + 15.

In percentages of standard length : body depth 25.7, head length 27.1 ; snout length 7.0, length of upper jaw 13.1, length of lower jaw 14.9 ; pectoral fin length 15.7, pelvic fin length 10.9, length of anal fin base 15.0 ; pre-dorsal distance 48.4, pre-pelvic distance 52.9, pre-anal distance 76.4.

Body moderately compressed, its depth a little less than head length. Snout a little shorter than eye diameter. Maxilla denticulated along lower edge, tip reaching to just beyond eye centre ; two supra-maxillæ present (Figure 7d), the 2nd (posterior) with lower part of expanded portion a little larger than upper. Height of lower jaw exactly 3.0 times in its length ; maximum height of lower jaw at or just behind mid-point of jaw, the upper edge of jaw not rising abruptly within the mouth.

Dorsal fin origin nearer to snout than to caudal base by $1\frac{1}{4}$ eye diameters. Pectoral fin tips failing to reach pelvic base by $1\frac{1}{3}$ eye diameters ; failing to reach vertical from dorsal origin by $\frac{1}{2}$ eye diameter. Pelvic fin base below 4th branched dorsal ray ; nearer to anal origin than to pectoral base by 1 pupil diameter. Anal fin origin nearer to pelvic base than to caudal base by 1 pupil diameter.

IDENTIFICATION. Bertin (1944) identified *Meletta suoerii* with *Pomolobus chrysochloris* (Rafinesque), but without any explanation. Hildebrand (1964) accepted this. But the gillraker count of 33 in the lectotype is too high for *A. chrysochloris* (20–24) ; it agrees with the counts given by Hildebrand for half-grown *A. pseudoharengus* (i.e. 32–36 in fish of 50–69 mm.), a species which shows an increase in gillraker number with size of fish. However, the lower jaw in the lectotype resembles that in *A. chrysochloris*, and does not show the steeply rising anterior profile described by Hildebrand for *A. pseudoharengus* (*loc. cit.*, figure 76d, on a fish of 48 mm.). The only fishes showing a high gillraker count with a gently rising lower jaw profile are *A. sapidissima* (Wilson) and *A. alabamæ* Jordan & Evermann. The latter seems the most likely on geographical grounds. The name *suoerii* has not been used as a senior synonym for fifty years and is thus a *nomen oblitum*.

ETHMALOSA Regan, 1917

Ethmalosa Regan, 1917, *Ann. Mag. nat. Hist.*, (8) **19** : 302 (Type : *Alausa dorsalis* Valenciennes = *Clupea fimbriata* Bowdich).

This genus stands between the European and New World shads (*Alosa*, *Brevoortia*, etc.) and the Indo-Pacific shads (*Hilsa*, *Gudusia*), bridging what would otherwise appear to be a useful tribal division between the two groups (Whitehead, 1965a).

The rather restricted clupeoid fauna of West Africa has resulted in fewer nominal species, but six have been described for the monotypic *Ethmalosa*:

Clupea fimbriata Bowdich, 1825 (no type material)

Harengula forsteri Valenciennes, 1847, p. 299

Meletta senegalensis Valenciennes, 1847, p. 370

Alosa dorsalis Valenciennes, 1847, p. 418

Alosa platycephalus Bleeker, 1863 (type examined)

Clupea setosa Steindachner, 1870 (type examined—original type locality an error, see Steindachner, 1882).

This synonymy is discussed by Whitehead (1967a).

48. *Harengula forsteri* Valenciennes, 1847
= *Ethmalosa fimbriata* (Bowdich, 1825)

Clupea fimbriata Bowdich, 1825, "Excurs. Madiera": 234, fig. 44 (Porto Praya, Cape Verde Is.).

Harengula forsteri Valenciennes, 1847, *Hist. Nat. Poiss.*, **20**: 299 (on figure by Forster, *ex* San-Jago du Cap Vert).

FIGURE. Valenciennes claimed that he based this species on an unpublished Forster drawing of a fish from St. Jago (Cape Verde Is.) which was labelled *Clupea fimbriata*. The 261 drawings of Forster* are bound in two volumes (Vol. 2, fishes) in the Zoological Library of the British Museum (Natural History). They contain only four clupeid-like fishes,

No. 234 *Esox argenteus* (= *Albula vulpes*)

No. 237 *Mugil salmonesus* (= *Elops hawaiiensis*)

No. 242 *Clupea setipinna* (= *Megalops cyprinoides*)

No. 243 *Clupea setirostris* (= *Thryssa setirostris*)

None of these is from St. Jago (although there are other fishes from that locality) and no drawings have been lost because 261 drawings are mentioned in Dryander's catalogue (1796) of the Banks library. No such drawing appears in the collection of Parkinson or Ellis drawings (1st and 3rd Cook voyages) in this museum. There is no mention of the name *Clupea fimbriata* amongst the Solander manuscripts, as Valenciennes noted (1847: 299).

It would seem that Valenciennes misquoted the source of this drawing. Cuvier (1828: 128) stated that Mrs Bowdich made copies for him of the Forster drawings, and an error of labelling may have resulted (see Whitehead, 1967a).

IDENTIFICATION. Günther (1868: 440) tentatively identified *Harengula forsteri* with *Clupea maderensis* (i.e. *Sardinella maderensis*), and Fowler (1936: 165) did the same. Ten pages later, however, Fowler again cited the Valenciennes name (erroneously as *Harengula fimbriata*) and referred it to *Ethmalosa fimbriata* (Bowdich). This latter identification seems much more likely. The finely ciliated scales found by Valenciennes in the drawing are characteristic of this West African shad, which was so named "because every scale is fringed, which makes the fish have a very peculiar

* George Forster, who accompanied his father, J. R. Forster, the official naturalist on Cook's 2nd voyage, 1772-5.

appearance" (Bowdich, 1825) (see Plate 5b). The type locality of *Clupea fimbriata* is Porto Praya, St. Jago Island, which suggests that Valenciennes may have had this drawing in mind and for some reason misquoted it. Forster's manuscript names were cited and identified by Lichtenstein (1844), but there is no clupeoid amongst them that is given as *fimbriata*.

49. *Meletta senegalensis* Valenciennes, 1847
= *Ethmalosa fimbriata* (Bowdich, 1825)

Meletta senegalensis Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 370 (Sénégal ; some fishes, 3 inches ; Jubelin).

TYPE MATERIAL. No specimens listed by Bertin (1940) and none apparently present in Paris. Since the nominal species is clearly a junior synonym of a well-known species there is no reason to select a possible neotype.

IDENTIFICATION. The fishes were evidently juveniles, and at this size there are only two other West African clupeids with such a deep body (depth a little less than 4 times in total length *vide* Valenciennes). *Ilisha africana* (Bloch) has a much longer anal fin (42 rays ; *cf.* 22 described in *M. senegalensis*), while *Sardinella cameronensis* Regan has a prominent dark spot at the base of the anterior dorsal rays (dark dorsal border in *M. senegalensis*).

Regan (1917a) ignored the Bowdich name *Clupea fimbriata*, headed his synonymy with *Meletta senegalensis*, but called the species *Ethmalosa dorsalis* (Valenciennes). Günther (1868 : 441) and subsequent authors used the name *Clupea* (or *Ethmalosa*) *dorsalis*, but Fowler (1936 : 117) argued that Bowdich's figure is clearly *Ethmalosa* (Bowdich, 1825 : fig. 44), and that his statement "... the ventral 19, and the pectoral 5 ; ... " was merely an error. The Bowdich figure (Plate 5b) certainly more closely resembles *Ethmalosa* than it does *Sardinella*, the only other West African genus with a species bearing fimbriated scales (i.e. *S. cameronensis*).

Alosa senegalensis Bennett, 1831, which Günther (1868 : 441) had wrongly assumed to be the basis of Valenciennes' *Meletta senegalensis*, is yet another *nomen oblitum* relating to *Sardinella aurita* (Whitehead, 1967a). Regan (1917b : 380), followed by Fowler (1936 : 167) and Svetovidov (1963 : 206), identified Bennett's fish as *Sardina pilchardus* (Walbaum), but this seems unlikely.

50. *Alausa dorsalis* Valenciennes, 1847
= *Ethmalosa fimbriata* (Bowdich, 1825)

Alausa dorsalis Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 418 (coast of Africa (West) ; ? specimens and size ; Rang).

TYPE MATERIAL. MNHN. 3175, 2 fishes, 95.7–159.5 mm. S.L., *ex* Gorée, coll. Rang. The larger of the two syntypes is chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 159.5 mm. S.L., *ex* Gorée (Senegal), coll. Rang, in good condition except for damage to 1st gill arch on left side, scales present, bearing paper tag, MNHN. 3175.

Br.St. 6, D iv 14 (1st minute), P i 14, V i 7, A iii 20, g.r. 108, scutes 17 + 12, scales *ca* 40 rows.

In percentages of standard length : body depth 36.1, body width 13.1, head length 34.5 ; snout length 7.0, eye diameter 8.2, length of upper jaw 14.4, length of lower jaw 16.2 ; pectoral fin length 21.5, pelvic fin length 12.5, length of anal fin base 18.6 ; pre-dorsal distance 51.5, pre-pelvic distance 54.6, pre-anal distance 76.5.

Body moderately compressed, belly keeled, width of body $2\frac{3}{4}$ times in its depth, the latter a little greater than head length. Snout a little shorter than eye diameter. Upper jaw with median notch, no teeth on pre-maxillae ; maxilla with smooth lower edge ; two supra-maxillae, the 2nd (posterior) with the lower part expanded posteriorly, at its deepest point almost as deep as maxilla (Figure 7b). Lower jaw with a distinct symphysial knob ; no teeth.

Pseudobranch present, exposed, long and attenuated, with ventral edge forming a ridge with a groove below ; length of pseudobranch $1\frac{1}{4}$ times eye diameter. Gill-rakers fine, slightly curved outwards on lower part of first two arches, bent outwards and then upwards on lower part of succeeding arches ; upper rakers on first arch in the form of an irregular N, those on succeeding arches V-shaped (exactly as described and figured by Monod, 1949). Line of lower edge of operculum rising steeply (meeting dorsal origin if projected) ; suboperculum triangular. Fronto-parietal region with paired cuneiform areas bearing 5 longitudinal striae.

Dorsal fin origin equidistant between snout tip and caudal base. Pectoral fin tip reaching to just beyond pelvic base ; no axillary scale present, but groove above 1st pectoral ray. Pelvic fin base below 1st branched dorsal ray, nearer to pectoral base than to anal base by $\frac{1}{2}$ eye diameter ; axillary scale present, just under $\frac{1}{2}$ length of fin. Anal origin nearer to pelvic base than to caudal base by $\frac{1}{3}$ eye diameter.

Scales with posterior borders bearing finger-like processes ; unexposed portion of scale with one large and 0-3 smaller vertical striae, the latter interrupted at the centre of the scale and becoming more numerous posteriorly.

COLOUR : upper $\frac{1}{3}$ of body slate-coloured, remainder of flanks golden ; a faint dark spot behind operculum, on a level with the eye. Dorsal with dark tip ; upper caudal lobe with dusky tip ; other fins hyaline.

IDENTIFICATION. The curious gillrakers, the pelvic count and the notched upper jaw are diagnostic of *Ethmalosa fimbriata*.

ETHMIDIUM Thompson, 1916

Ethmidium Thompson, 1916, *Proc. U.S. nat. Mus.*, **50** : 458 (Type : *Clupea (Alosa) notacanthoides* Steindachner = *Alosa maculata* Valenciennes).

Since Regan (1917a), authors have accepted that the notched upper jaw and long, closely-set gillrakers in *Ethmidium* place this genus amongst the shads, although the presence of dorsal scutes suggests affinities with the "double-armoured herrings", i.e. the modern *Potamalosa* and *Hyperlophus* (subfamily Pellonulinae) and the fossil diplomystids (*Diplomystus*, *Knightia*, etc.).

Five nominal species of *Ethmidium* have been proposed, all from Peru and Chile.

Alausa maculata Valenciennes, 1847 (Chile)

Alausa coerulea Valenciennes, 1847 (Chile)

Clupea notacanthus Günther, 1868 (Chile)

Clupea (Alosa) notacanthoides Steindachner, 1869 (? Mazatlan)

Ethmidium chilcae Hildebrand, 1946 (Peru)

The Steindachner locality is questioned because a. the Mazatlan specimen of *Clupea setosa* is the West African *Ethmalosa fimbriata*—see p. 85 ; and b. no subsequent Mexican records occur. The type of *C. notacanthoides* cannot now be found (Kähsbauer, *pers. comm.*).

Hildebrand (1946 : 84–85) separated his Peruvian specimens (*E. chilcae*) from specimens of *E. maculatum* from Chile in the following way.

	<i>E. maculatum</i>	<i>E. chilcae</i>
Head in S.L.	3.25–3.4	3.0–3.1
Depth in S.L.	2.75–2.9	2.8–3.1
Caudal peduncle depth in head l.	2.80–2.95	3.20–3.75
Pectoral tip short of pelvic base by :	eye diam.	pupil diam.
Ventral outline	more convex	
Scales	nearly smooth	denticulate

This separation is not entirely satisfactory, but it can be accepted until more specimens have been examined. The two species may well intergrade in the centre of their range.

51. *Alausa maculata* Valenciennes, 1847
= *Ethmidium maculatum* (Valenciennes, 1847)

Alausa maculata Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 430 (Valparaiso (Chile) ; one fish, no size ; d'Orbigny).

TYPE MATERIAL. MNHN. 1890, 1 fish, 238.0 mm. S.L., *ex* Valparaiso, coll. d'Orbigny.

DESCRIPTION. *Holotype*, a fish of 238 mm. S.L., *ex* Valparaiso (Chile), coll. d'Orbigny, in very poor condition, caudal shattered, right flank with horizontal slit from pectoral base to anal origin, snout smashed, lower jaw loose, dorsal and anal fins damaged, MNHN. 1890.

Br.St. 10, D v 19 (1st minute), P i 17, V i 6, A iii 14, g.r. (about 150), scutes 20 + 17, dorsal scutes 25.

In percentages of standard length : body depth 34.2, body width 12.3, head length 29.7 ; snout length 5.5 (approx.), eye diameter 6.2 (approx.), length of upper jaw 14.7, length of lower jaw 16.4 ; pectoral fin length 16.1, pelvic fin length 11.7, length of anal fin base 13.8 ; pre-dorsal distance 49.5, pre-pelvic distance 51.7, pre-anal distance 81.3.

Body moderately compressed, its width $2\frac{3}{4}$ times in its depth, belly sharply keeled. Head length a little less than body depth. Keeled scutes present from occiput to dorsal origin. Upper jaw with median notch ; no teeth on pre-maxillae ; maxilla with smooth lower border ; two supra-maxillae present, the 1st (anterior) broadly

overlapping the anterior half of the lower part of the expanded portion of the 2nd (posterior) ; the latter with an expanded portion three times as long as the slender anterior shaft of the bone (Figure 7e). Posterior margin of gill opening without fleshy lobes on cleithrum. Anterior margin of operculum inclined forwards at an angle of 45° . Fronto-parietal region with paired cuneiform areas bearing 4-5 longitudinal striae.

Pseudobranch present, exposed, its length $1\frac{1}{2}$ times eye diameter, ventral border slightly ridged. Gillrakers very long and slender, $1\frac{1}{3}$ times length of corresponding gill filaments, $1\frac{1}{3}$ times eye diameter ; epibranchial gillrakers of 1st arch folding over ceratobranchial series ; no gillrakers on posterior face of 3rd arch.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{1}{4}$ eye diameters. Pectoral fin tips failing to reach pelvic base by $1\frac{1}{4}$ eye diameters ; a groove present above first pectoral ray. Pelvic fin base below 3rd or 4th branched dorsal rays, nearer to pectoral base than to anal origin by almost 2 eye diameters ; axillary scale present, about $\frac{1}{2}$ length of fin. Anal fin origin nearer to caudal than to pelvic base by almost 2 eye diameters.

Scales with pectinated posterior borders and faint horizontal striae on exposed portion ; unexposed portion with up to five wavy and irregular but complete vertical striae.

COLOUR : upper $\frac{1}{4}$ of body grey-brown ; remainder of flank silver with a horizontal series of 22 small dark oval spots from operculum to caudal base, on a level with the eye ; a second series of 11 dark oval marks below this ; and a third series, of 3-4 round dark marks below this, as closely spaced as those in the two rows above.

IDENTIFICATION. The presence of dorsal scutes, the lack of gillrakers on the posterior face of the 3rd arch, the high branchiostegal count, etc. are diagnostic of the genus, and the locality, proportional measurements and pectoral fin length distinguish this fish from Hildebrand's *E. chilcae* (see under genus).

52. *Alausa coerulea* Valenciennes, 1847
= *Ethmidium maculatum* (Valenciennes, 1847)

Alausa coerulea Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 432 (no locality ; some fishes, 6-7 inches ; d'Orbigny ; also, a figure by Gay).

TYPE MATERIAL. Bertin (1940) does not list specimens of *Alausa coerulea* and there are no specimens in Paris that could be the types.

IDENTIFICATION. The description of this species is poor and amounts to : similar to *Alausa dorsalis* except :

1. body much more thick-set
2. body depth only 3 in total length (cf. 4 times)
3. belly profile very concave.

Of possible shad-like clupeids, *Opisthonema* can be ruled out (filamentous last dorsal ray), *Sardinops* is too slender, as also are *Harengula thrissina* and *Lile stolidifera*, leaving only *Ethmidium*. Failure to mention the dorsal scutes is not a drawback since Valenciennes does not describe them for *Alausa dorsalis* either. The Gay

figure, on which Valenciennes based his colour description, may have been from a long dead specimen ; the spots on the flanks are not mentioned and had perhaps faded. Alternatively, the drawing may have been of an unusually deep *Harengula thrissina*.

HILSA Regan, 1917

Hilsa Regan, 1917, *Ann. Mag. nat. Hist.*, (8) **19** : 303 (Type : *Paralosa durbanensis* Regan = *Clupea kelee* Cuvier).

The Indo-Pacific shads have recently been reviewed (Whitehead, 1965a) and the classification and nomenclature remains unaffected by the present study.

Regan (1917a) was the first to make a distinction between the Atlantic and New World shads and those of the Indo-Pacific based on the manner in which the upper and lower gillraker series fold over each other. Valenciennes placed all his Indo-Pacific shads in the genus *Alausa* except for *Clupeonia blochii*, a doubtful name in any case, and one founded solely on Bloch's figure of *Clupea sinensis*.

53. *Clupea kelee* Cuvier, 1829 = *Hilsa kelee* (Cuvier, 1829)

Clupea kelee Cuvier, 1829, *Règne Animal*, 2nd ed., **2** : 320 (on Russell's *Keelee*, No. 195, ex Vizagapatnam).

TYPE MATERIAL. *Clupea kelee* was founded solely on the description and figure by Russell (1803). There is no material in Paris which could have been available to Cuvier at the time, and indeed none that would be suitable for a neotype designation. There appear to be no extant Russell specimens from which the drawing might have been made. The species is, however, well known and distinct from all others in this genus, and there is at present no necessity for a type.

IDENTIFICATION. Russell's figure (reproduced here as Plate 6a) shows the rather short maxilla of *Hilsa kelee* or *H. toli* (tip reaching beyond eye in *H. ilisha*). The figure more closely resembles *H. kelee* than *H. toli* in the depth of the fish ($2\frac{3}{4}$ times in S.L.) and in the shape of the opercular series. Even though the opercular bones were highly stylized by Russell's anonymous Indian artist, the steeply rising lower border of the operculum and the almost triangular suboperculum of the drawing are highly suggestive of *H. kelee* and not *H. ilisha*.

Russell's meristic counts can be compared with those from 24 Indian Ocean specimens.

Br.St. 5, D 15, P 15, V 8, A 18, C 20 (Russell, 1803).

Br.St. (n.r.), D iv 13-14, P (n.r.), V i 7, A iii 17-19, C (n.r.) (Whitehead, 1965a).

Allowing for some miscounting or failure to count some of the small unbranched rays, the agreement is tolerable. Russell gives the total length as six inches " but they grow to eight or ten ". *Hilsa kelee* is recorded only up to 220 mm. ($8\frac{3}{4}$ inches) by Regan (1917a), so that Russell's larger fishes may have been *Hilsa ilisha*.

54. *Clupeonia blochii* Valenciennes, 1847= *Hilsa kelee* (Cuvier, 1829)

Clupea chinensis Cuvier, 1817, *Règne Animal*, 1st ed., 2 : 174, footnote (emendation of *Clupea sinensis* Bloch, fig. 405).

Clupeonia blochii Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 353 (on Bloch's *Clupea sinensis*, figure 405 on a Tranquebar specimen sent by the Rev. John).

IDENTIFICATION. The identity of the problematical *Clupea sinensis* of Bloch (1795) has been discussed elsewhere (Whitehead, 1965a). Prof. Peters, who had examined the supposed model for the drawing, is quoted by Day (1878) as being of the opinion that the specimen was *Hilsa toli*, but the caudal lobes (in the drawing) are too short. Günther (1868 : 446) considered the species a synonym of *Clupanodon* (i.e. *Hilsa*) *ilisha*, but most of Günther's "*ilisha*" material is *H. kelee* (Whitehead, 1965a : 145).

Bloch's figure (shown here as Plate 6b) is not inconsistent with *Hilsa kelee* apart from the absence of spots on the flanks ; these are not always retained in preserved material, except for the first, just behind the operculum, which is almost always present. Bloch's figure shows a rising lower border of the operculum (as in *Hilsa kelee*). The black borders of the caudal and dorsal fins, while highly exaggerated for any clupeid, are again consistent with *Hilsa kelee*. The only other Indian clupeids with such a deep body (depth $2\frac{2}{3}$ in S.L.) are *Sardinella brachysoma* Bleeker and *Escualosa thoracata* (Valenciennes), neither of which have a pronounced black caudal and dorsal border.

The size of Bloch's figure, nearly 11 inches total length, is no clue. None of the three species mentioned here reaches that size, but Bloch's figures are evidently not life-size ; for example, the succeeding plate shows a magnificent 12-inch pilchard (*Sardina pilchardus* rarely exceeds $7\frac{1}{2}$ inches). Bloch, quoting the Rev. John, gives the length of *C. sinensis* as 10 inches, which is certainly much too high for *Sardinella brachysoma* and *Escualosa thoracata* and a little high for *Hilsa kelee*. The Rev. John may well have had *Hilsa ilisha* in mind, a larger and more common species and one which runs up rivers to spawn, a feature also noted by the Rev. John of Tranquebar.

I conclude that Bloch's figure, if it reasonably well portrays the specimen, is best identified with *Hilsa kelee*, but that at least some of the data supplied by the Rev. John was based on *Hilsa ilisha*. Cuvier (1817) emended Bloch's name to *Clupea chinensis*, recognizing the species as a shad allied to *Alosa alosa*, but he abandoned the name in the 2nd edition of the *Règne Animal*. The name *Clupea sinensis* is not given priority here because of the doubts and misuse that have surrounded it.

55. *Clupea palasah* Cuvier, 1829= *Hilsa (Tenuulosa) ilisha* (Ham. Buch., 1822)

Clupanodon ilisha Hamilton-Buchanan, 1822, *Fishes of the Ganges* : 243, 382, pl. 19, fig. 73 (type material from : Ganges estuary, Patua, Goya Rarra, Calcutta, Dhasa).

Clupea palasah Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 320 (on *Palasah* Russell, 1803, *Fishes of Coromandel*, 2 : 77, plate 198, ex Vizagapatnam).

Alosa palasah : Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 432 (*part*, i.e. Ganges and Malabar specimens only).

TYPE MATERIAL. There are no specimens in Paris with registration dates prior to 1829, and it is virtually certain that Cuvier based his *Clupea palasah* solely on the Russell description and figure. There are now five of Valenciennes' *palasah* specimens in Paris, three of which are *Hilsa ilisha*.

MNHN. 3685-6, 2 fishes, 297-323 mm. S.L., ex Ganges, coll. Dussumier.

MNHN. 4976, 1 fish, 195 mm. S.L., ex Malabar coast, coll. Dussumier.

The specimens in jars MNHN. 3684 and MNHN. 3687, which were identified as *Hilsa ilisha* by Bertin (1940) are *Hilsa toli* (Whitehead, 1965a).

The following description refers to the Malabar specimen and the two Ganges fishes collected by Dussumier. In the event that a neotype is required for *Clupea palasah*, the largest of the Ganges specimens would be suitable, unless a Vizagapatnam specimen can be procured.

DESCRIPTION. A fish of 323 mm. S.L., ex Ganges River, coll. Dussumier, in good condition, MNHN. 3685.

A fish of 297 mm. S.L., ex Ganges River, coll. Dussumier, in fair condition, MNHN. 3686.

A fish of 195 mm. S.L., ex Malabar coast, coll. Dussumier, in good condition, MNHN. 4976.

(The measurements are given in that order.)

Br.St. 6, D v 16, iv 15, iv 15, P i 14, i 13 (n.r.), V i 7, i 7, i 7, A iii 18, iii 17, iii 17, g.r. (n.r.), scutes 17 + 14, 17 + 14, (n.r.), scales 41, (n.r., n.r.).

In percentages of standard length : body depth 35.3, 36.0, 32.0, head length 30.9, 31.7, 32.6 ; snout length 6.7, 6.2, 6.8, eye diameter 4.9, 5.1, 5.9, length of upper jaw 13.2, 13.1, 13.5, length of lower jaw 16.0, 15.9, (n.r.), height of operculum 13.6, 14.9, 14.5, breadth of operculum 8.0, 7.5, 8.2 ; pectoral fin length 18.4, 19.2, 19.9, pelvic fin length 10.8, 11.1, 12.3, length of anal fin base 17.0, 17.5, 17.3, length of lower caudal lobe 25.7, 27.3, 28.0 ; pre-dorsal distance 50.0, 50.5, 50.5, pre-pelvic distance 53.5, 53.0, 52.2, pre-anal distance (n.r.).

Body compressed, its depth greater than head length, belly sharply keeled. Snout length greater than eye diameter. Upper jaw with median notch ; no teeth on pre-maxillae ; lower edge of maxilla smooth, expanded portion without longitudinal ridges, tip of maxilla reaching about to vertical from posterior eye border ; two supra-maxillae, the 2nd (posterior) rather small.

Pseudobranch long, attenuated, with lower margin ridged and a groove below it. Gillrakers fine, numerous, slightly curved, but not curled outwards, those of epibranchial of first arch not folding over ceratobranchial series at angle of arch. Operculum breadth 1.86, 1.95, 1.77 times in its height. Dorsal surface of head thickly covered by skin, no fronto-parietal striated areas.

Dorsal fin origin nearer to snout tip than to caudal base by $1\frac{3}{4}$ eye diameters. Pelvic base below 3rd branched dorsal ray, nearer to pectoral base than to anal origin by just under 1 pupil diameter. Anal origin equidistant between pelvic and caudal bases. Caudal fin moderate, not as long as head length.

IDENTIFICATION. The groove below the pseudobranch, the short caudal fin and the rather narrow operculum place these fishes in *Hilsa (Tenuulosa) ilisha*. The scale count of 41 is rather low, but is within the range recorded by Pillay (1957).

56. *Alausa toli* Valenciennes, 1847
= *Hilsa (Tenuulosa) toli* (Valenciennes, 1847)

Alausa toli Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 435 (Pondichéry and Bombay ; some fishes, $4\frac{1}{2}$ –28 inches ; Leschenault, Roux).

TYPE MATERIAL. *MNHN*. 3939, 1 fish, 460 mm. S.L., *ex* Pondicherry, coll. Leschenault (DRY).

MNHN. 3940, 1 fish, 440 mm. S.L., *ex* Bombay, coll. Roux (DRY).

MNHN. 3684, 1 fish, 314 mm. S.L., *ex* Bombay, coll. Dussumier.

MNHN. 3687, 1 fish, 216 mm. S.L., *ex* Pondicherry, coll. Bélanger.

The first two were not listed by Bertin (1940), and the last two were listed by him as *Alausa palasah* material. The Leschenault specimen has already been chosen as lectotype, but a complete description of it was not given (Whitehead, 1965a). The remaining fishes are paralectotypes.

DESCRIPTION. *Lectotype*, a fish of 455 mm. S.L. (565 mm. tot.l., caudal tips damaged, estimated 570 mm.), *ex* Pondicherry, coll. Leschenault, a dried and mounted fish with a glass eye, in poor condition, scales retained, post-pelvic scutes, caudal and dorsal fin damaged, *MNHN*. 3939.

Br.St. (indet.), D (damaged), P i 15, V i 7, A iii 16, g.r. (indet.), scutes 17 + ?, scales 35 or 36 + 4 on caudal base.

In percentages of standard length : body depth 30.6, head length 24.3 ; snout length 6.3, eye diameter (glass eye) 3.4, length of upper jaw 10.7, length of lower jaw 13.2 ; pectoral fin length 16.9, pelvic fin length 9.8, length of anal base 13.8 ; pre-dorsal distance 45.7, pre-pelvic distance 49.3, pre-anal distance 78.8.

Body compressed, deeper than head length, belly sharply keeled. Snout length twice eye diameter, but this is probably exaggerated by mounting of glass eye. Upper jaw with median notch ; maxilla to about vertical from posterior eye border ; two supra-maxillae.

Pseudobranch and gillrakers cannot be examined.

Dorsal fin origin nearer to snout tip than to caudal base by about 3 eye diameters. Pelvic base nearer to pectoral base than to anal origin by 2 eye diameters. Anal origin nearer to caudal base than to pelvic base by $2\frac{1}{4}$ eye diameters (about equidistant between caudal base and *tips* of pelvic fins). Caudal length estimated to have exceeded head length by 4 mm. ; caudal finely scaled.

IDENTIFICATION. Although the pseudobranch cannot be examined, the low scale count and long caudal fin distinguish this specimen from *Hilsa ilisha*. Also, the anal origin in *H. ilisha* is equidistant between the caudal base and the pelvic base (pelvic *tips* in this specimen).

57. *Alausa argyrochloris* Valenciennes, 1847
= *Hilsa (Tenuulosa) toli* (Valenciennes, 1847)

Alausa argyrochloris Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 440 (presumed Bombay, and Ile-de-France ; one fish, 6 inches, plus two others ; Dussumier, and Quoy & Gaimard).

TYPE MATERIAL. *MNHN*. 2738, 1 fish, 121 mm. S.L., *ex* Bombay, coll. Dussumier.

Although Valenciennes mentions two other specimens (Quoy & Gaimard), they did not figure in the original description but are stated to have been "absolument semblables". The point is stressed here because these two specimens (MNHN. 3753) were misidentified: they are *Sardinella jussieu* (see p. 60). The Bombay fish is therefore the holotype of *Alausa argyrochloris*. Bertin (1940) considered the other two specimens as paratopotypes, but that is incorrect.

DESCRIPTION. *Holotype*, a fish of 121 mm. S.L., ex Bombay, coll. Dussumier, in good condition but with horizontal slit along right flank under pectoral fin, MNHN. 2738.

Br.St. (n.r.), D iv 14, P i 14, V i 7, A iii 15, g.r. 66, scutes 16 + 12, scales 38 + 3 on caudal.

In percentages of standard length: body depth 36.5, head length 27.3; snout length 6.2, eye diameter 5.9, length of upper jaw 12.4, length of lower jaw 14.5; operculum height 13.3, operculum breadth 6.5; pectoral fin length 18.6, pelvic fin length 12.6, length of anal fin base 15.4; pre-dorsal distance 47.2, pre-pelvic distance 54.0, pre-anal distance (n.r.).

Body compressed, much deeper than head length, belly sharply keeled. Snout a little longer than eye diameter. Upper jaw with median notch. Operculum breadth twice in its height.

Pseudobranch present, exposed, its length $1\frac{1}{4}$ times eye diameter, lower edge not ridged and without groove below. Gillrakers slender, $1\frac{1}{5}$ times length of corresponding gill filaments, tips of rakers on first arch pointed but slightly clubbed on succeeding lower arches.

Dorsal fin origin nearer to snout tip than to caudal base by 2 eye diameters. Pectoral fin tips failing to reach pelvic base by just over 1 eye diameter; axillary scale present, 1.5 times in length of fin. Pelvic fin base below 3rd branched dorsal ray, nearer to pectoral base than to anal origin by 1 pupil diameter; axillary scale present, reaching $\frac{2}{3}$ along fin. Anal origin nearer to caudal base than to pelvic base by $\frac{1}{2}$ eye diameter.

Scales with eroded posterior borders; unexposed portion with one large and 2-7 finer uninterrupted vertical striae.

COLOUR: upper $\frac{1}{3}$ slate-green, rest of flanks golden. Scales with fine brown speckling on exposed portion.

IDENTIFICATION. Günther (1868: 413) placed *Alausa argyrochloris* in his list of doubtful species of *Clupea*, Regan (1917a) ignored the name, and Fowler (1941) placed it as a tentative synonym of *Harengula ovalis* (Bennett), i.e. *Herklotsichthys punctatus* (Rüppell). The present specimen is clearly a member of *Hilsa* (*Tenuulosa*) and the pseudobranch form places it in *H. toli*.

58. *Chatoessus tampo* Valenciennes, 1848
= ? *Hilsa* sp.

Chatoessus tampo Valenciennes, 1848, *Hist. Nat. Poiss.*, 21: 117 (Malaya; no specimens, on drawing by Major Farquhar).

IDENTIFICATION. Valenciennes described this species from a drawing by Major Farquhar of a fish known in Malayan as *Ekan-Tampo*. The description suggests a

fish similar to the previous species, i.e. *Anodontostoma chanpole* (Ham. Buch.), but,

1. body much more elongate
2. caudal lobes longer and more pointed
3. back greenish, belly lilac, fins yellow but caudal black-bordered
4. no spot near operculum.

The name *Chatoessus tampo* was considered a doubtful species by Günther (1868 : 406), and was ignored by Weber & DeBeaufort (1913) and Regan (1917a). Fowler (1941) seems to have been one of the few to consider it, and he placed it tentatively in the synonymy of *Anodontostoma chacunda* (Ham. Buch.), presumably because Valenciennes had considered it close to that species. But the more elongate body and absence of a humeral spot or blotch make this unlikely.

The long and pointed caudal lobes remind one of *Hilsa*, and the colouration in *H. ilisha* is suggestive : " Silvery, shot with gold and purple ; no spots in the adult . . ." (Pillay & Rosa, 1963). A black-bordered caudal is shown in Day's illustration of the species (Fig. 9 in Whitehead, 1965a). Geographically, *Hilsa ilisha* is possible, but so too are *H. kelee*, *H. toli* and *H. macrura*, the last two with very long caudal lobes, often dark-edged. In addition, *H. macrura* " forms the object of a very important fishery at the mouth of some rivers in Borneo, Malacca and Sumatra " (Weber & DeBeaufort, 1913).

For the present, *Chatoessus tampo* is best identified as most likely a species of *Hilsa*.

59. *Alausa microlepis* Valenciennes, 1847
= *Gudusia chapra* (Ham. Buch., 1822)

Clupanodon chapra Hamilton-Buchanan, 1822, *Fishes of the Ganges* : 248, 383 (type locality : Upper Ganges).

Alausa microlepis Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 439 (Bengale ; 2 fishes, to 6½ inches ; Duvaucel).

TYPE MATERIAL. MNHN. 3696, 2 fishes, 76.5–143.7 mm. S.L., ex Bengal, coll. Duvaucel.

The smaller of these is damaged, the head now being severed from the body. The larger one, bearing a paper tag, is here selected as lectotype.

DESCRIPTION. *Lectotype*, a fish of 143.7 mm. S.L., ex Bengal, coll. Duvaucel, in fair condition, MNHN. 3696.

Br.St. 6, D iv 11, V i 7, A iii 20, g.r. 218, scutes 18 + 10, scales about 90.

In percentages of standard length : body depth 34.2, head length 27.5 ; snout length 5.5, eye diameter 6.6, length of upper jaw 10.7, length of lower jaw 12.9 ; pectoral fin length 21.6, pelvic fin length 12.6, length of anal fin base 20.7 ; pre-dorsal distance 49.7, pre-pelvic distance 48.8, pre-anal distance 72.0.

Body strongly compressed, much deeper than head length, belly sharply keeled. Snout a little shorter than eye diameter. Upper jaw with median notch ; no pre-maxillary teeth, maxilla with smooth lower border ; two supra-maxillae, the 1st long ($\frac{2}{3}$ eye diameter), the 2nd (posterior) slightly shorter, lower part of expanded portion much deeper than upper, posterior tip of bone formed by an acute angle

(Figure 7c). Lower jaw with distinct symphyseal knob. Fronto-parietal region with paired cuneiform areas bearing 7–8 longitudinal striae; striae not continued forward to above eye (*cf. Hilsa kelee*). Lower edge of operculum rising steeply, if projected cutting dorsal profile just before dorsal origin.

Pseudobranch present, exposed, very long and attenuated, $1\frac{1}{2}$ times eye diameter, lower edge ridged with groove below. Gillrakers very fine and slender, close set, every 3rd or 4th raker with an external skinny flap at base of raker; longest rakers of 1st arch almost equal to length of corresponding gill filaments, $\frac{1}{2}$ eye diameter; epibranchial rakers on anterior part of all arches directed upwards to form a groove; epibranchial rakers on posterior part of 3rd arch present, numerous, fine and close-set. Mediopharyngobranchial present, bearing many rakers.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{1}{2}$ eye diameter. Pectoral fin tips almost reaching to pelvic base. Pelvic base just in advance of vertical from 1st unbranched dorsal ray, nearer to pectoral base than to anal origin by $\frac{1}{3}$ eye diameter. Anal origin nearer to pelvic base than to caudal base by $1\frac{1}{4}$ eye diameter; base of fin enclosed in scaly sheath.

Scales very small, posterior edge smooth; unexposed portion with a single continuous vertical striation.

COLOUR: upper $\frac{1}{4}$ of body grey-brown, remainder of flanks golden-brown without stripes or spots. Fins hyaline, but dark spot at bases of unbranched dorsal rays.

IDENTIFICATION. The small and numerous scales place this specimen in *Gudusia*. Two species of *Gudusia* are recognized, *G. chapra* and *G. variegata* (Day), the latter being much deeper, with a shorter head and more branched anal rays (22–26; *cf.* 19–22—Whitehead, 1965a). The present specimen is clearly *G. chapra*.

Subfamily—DOROSOMATINAE

Regan (1917a) strongly deplored the separation of the gizzard shads from the shads, and most modern authors recognize at most a subfamily, Dorosomatinae. The New World species (which have two supra-maxillae) have been reviewed by Miller (1960, 1964) and the Old World genera (with a single supra-maxilla) by Whitehead (1962).

Chatoessus Cuvier, 1829 = *Dorosoma* Rafinesque, 1820

Dorosoma Rafinesque, 1820, *West. Rev. misc. Mag.*, **2** (3) (April): 171; *Idem*, 1820, *Ichthyol. Ohiensis* (December): 39 (Type: *Dorosoma notata* Rafinesque = *Megalops cepediana* LeSueur).

Chatoessus Cuvier, 1829, *Règne Animal*, 2nd ed., **2**: 320 (Type: none indicated); Valenciennes, 1848, *Hist. Nat. Poiss.*, **21**: 94 (type of *Chatoessus* restricted to *Megalops cepediana* Le Sueur)

Cuvier proposed the genus *Chatoessus* for his Cailleu-Tassarts, defined as herrings with a filamentous last dorsal ray and made up of two groups:

- a. Jaws equal, snout not prominent: Duhamel's *Cailleu-tassard des Antilles* (i.e. *Opisthonema oglinum*) which he equated with Bloch's *Clupea thrissa* (i.e. *Clupanodon thrissa*); Russell's *Peddakome* (i.e. *Nematalosa come*); and LeSueur's *Megalops oglina*, *M. notata* and *M. cepediana*.

- b. Snout more prominent than lower jaw : Bloch's *Clupea nasus* (i.e. *Nematalosa nasus*) with which he equated Russell's *Kome*.

The genus was thus composite and Cuvier did not give prominence to any one of the species. Valenciennes (1848 : 94), having more carefully examined more extensive material, was able to dismiss the filamentous dorsal ray as a feature common to many clupeoid groups. He stated that, although he conserved the name *Chatoessus*, the genus had to be re-defined. The filamentous dorsal ray does not occur in some of his species, but all were united in having :

1. Mouth small, toothless, inferior
2. Snout prominent, upper jaw notched, lower jaw with corresponding knob on symphysis
3. Gill arches Z-shaped ; he also described the mediopharyngobranchial which bears gillrakers
4. Deep, sharply scuted body
5. Gizzard present ; numerous pyloric caecae forming a gland-like mass
6. Ovaries forming a plate folded on itself, freely floating in the abdominal cavity.

This diagnosis is cited here because it shows that Valenciennes, once freed from the almost hypnotic effect of dentitional patterns, was able to construct a clupeoid group as natural as any modern one. Where he had specimens, his species of *Chatoessus* are all gizzard shads, and no gizzard shads are found amongst his other genera. Valenciennes himself (with no trace of self-criticism, however) cites this as proof that a good natural group can be made by following nature in all its variations and not by concentrating on a single character, which " par sa rigoureuse application, établie tout de suite une méthode artificielle avec tous ses défauts."

60. *Megalops bimaculata* Valenciennes, 1848
= *nomen nudum*

Megalops bimaculata Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 104 (name in synonymy of *Chatoessus cepedianus*).

Valenciennes received some juveniles (5½ inches) of *Megalops cepedianus* (i.e. *Dorosoma cepedianum*) from LeSueur which bore the manuscript name *Megalops bimaculata*. But, by examining specimens of intermediate size, Valenciennes was satisfied that the dark markings were merely a juvenile character. The name *Megalops bimaculata* was published as a synonym, thus by implication agreeing in every respect with Valenciennes' description of *Chatoessus cepedianus*. The name is not, however, available since it has not been adopted as the name of a taxon nor used as a senior homonym (International Code, Article 11(d)).

CLUPANODON Lacepède, 1803

Clupanodon Lacepède, 1803, *Hist. Nat. Poiss.*, **5** : 468, 470 (Type : *Clupea thrissa* Linnaeus, designated by Bleeker, 1872, *Atlas Ichthyol. Néerland.*, **6** : 112) (*Clupanodon jussieu* Lacepède designated type by Jordan & Gilbert, 1882, *Proc. U.S. nat. Mus.* : 574—invalid).

Lacepède (1803 : 468) loosely defined his genus *Clupanodon* as having :

1. More than 3 branchiostegal rays
2. Belly keeled, the keel denticulated or very acute
3. Anal fin separated from caudal
4. A single dorsal fin
5. No jaw teeth.

Lacepède included six species (Table 1), now placed in as many different genera, giving no one species prominence (except perhaps *Clupanodon thrissa* by virtue of being listed first). Cuvier (1817, 1829) ignored the genus as such, but Hamilton-Buchanan (1822) used it for certain Indian gizzards shads (*Gonialosa* and *Anodontostoma*) and shads (*Hilsa* and *Gudusia*), basing his diagnosis on that of Lacepède. Valenciennes (1847, 1848) found no use for *Clupanodon* as a senior synonym, and Günther (1868) completely ignored it, not even including it in his synonymies of *Clupea*, *Chatoessus*, etc. Finally, a type was designated by Bleeker (1872), who made a passing reference to *Clupanodon* "et son espèce type, le *Clupanodon thrissa*", presumably *Clupea thrissa* Linnaeus, but without any indication whether he interpreted this as an American or a Chinese species (see p. 74). The name *Thrissa* Rafinesque, 1815 had been proposed to replace *Clupanodon*, but without a clear type designation of the latter, a replacement was meaningless. The designation of *Clupanodon jussieu* Lacepède as type of *Clupanodon* by Jordan & Gilbert (1882) did not help matters, any more than did Gill's designation of "*Opisthonema thrissa* Gill" as type of the American genus *Opisthonema*.

The confusion was only finally straightened out by Regan (1917a), who accepted Bleeker's *Clupanodon thrissa* as being a Chinese fish based on the Chinese element (*ex* Osbeck) in Linnaeus' *Clupea thrissa*, and rigidly excluded reference to American material.

**61. *Chatoessus osbecki* Valenciennes, 1848
= *Clupanodon thrissa* (Linnaeus, 1758)**

Chatoessus osbecki Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 106 (coasts of China ; some fishes, near 4 inches ; Callery).

TYPE MATERIAL. MNHN. 3675, 2 fishes, 71.9–76.0 mm. S.L., *ex* China, coll. Callery (1846).

The larger of the two is here selected as lectotype.

DESCRIPTION. *Lectotype*, a fish of 76.0 mm. S.L., *ex* China, coll. Callery, in poor condition, desiccated, lower jaw broken, scales gone, bearing paper tag, MNHN. 3675.

Br.St. 5, D iii 13, P i 13, V i 7, A ii 22, g.r. (very numerous), scutes 18 + 11, scales (indet.).

In percentages of standard length : body depth 37.4, head length 28.8 ; snout length 6.5, eye diameter 7.2, length of upper jaw 11.6, length of lower jaw 12.9 (approx.) ; pectoral fin length 12.3 (tip broken), pelvic fin length 9.5, length of anal fin base 25.6, length of filamentous last dorsal ray 18.3 ; pre-dorsal distance 48.7, pre-pelvic distance 50.8, pre-anal distance 68.5.

Body compressed, deeper than head length, belly sharply keeled. Snout a little shorter than eye diameter. Upper jaw with median notch ; maxilla with smooth lower edge ; no supra-maxillae found ; lower jaw with outer edge hardly flared outwards. Fronto-parietal region with paired cuneiform areas bearing 4-5 longitudinal striae.

Pseudobranch present, exposed, equal in length to 1 eye diameter. Gillrakers numerous, fine, slender, $1\frac{1}{4}$ times length of corresponding gill filaments, $\frac{1}{2}$ eye diameter. Suboperculum sub-triangular, dorsal and anterior borders forming an obtuse angle.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{3}{4}$ eye diameter ; last dorsal ray filamentous, $1\frac{1}{2}$ times in head length. Pectoral fin tips failing to reach pelvic base by $\frac{1}{2}$ eye diameter. Pelvic fin base equidistant between pectoral base and anal origin. Anal fin origin nearer to pelvic base than to caudal base by 2 eye diameters.

COLOUR : upper $\frac{1}{4}$ of body brown, flanks silver, or gold where a few scales remain ; fins hyaline.

IDENTIFICATION. The low post-pelvic scute count, the barely flared dentary and the triangular sub-operculum place this specimen in the monotypic genus *Clupanodon*. Günther (1868 : 406) placed this Valenciennes species amongst his doubtful species of *Chatoessus*, but Regan (1917a) and subsequent authors have recognized it as a synonym of *Clupanodon thrissa*.

Valenciennes thought that there was no doubt that he had the *Clupea thrissa* of Osbeck (1757) in front of him. His reason for giving the fish another name seems to have been that Linnaeus (1758) swamped Osbeck's description with descriptions of American species, thus leaving the true Chinese species without an unequivocal name. The identity of the Chinese fishes referred to as *thrissa*, *triza*, etc. is discussed elsewhere (Whitehead, 1966a).

Subfamily—PRISTIGASTERINAE

The genera of the Pristigasterinae can be identified adequately from the key given by Berry (1964c), but the species still require revision. The review by Norman (1923) has here been supplemented by papers by Petersen (1958) and Hildebrand (1964) for New World species ; and Whitehead (1966a) and Whitehead, *et alii* (1966) for Indo-Pacific species.

The species are mainly from tropical seas. Lacepède described one new pristigasterine (*Odontognathus mucronatus*), which he kept quite separate from his other clupeoids because it lacked pelvic fins. Cuvier (1829) added two more new species, and Valenciennes (1847) recognized a total of 21 species, placing them in 3 genera (*Pellona*, *Pristigaster*, and *Gnathobolus* = *Odontognathus*).

PRISTIGASTER Cuvier, 1817

Pristigaster Cuvier, 1817, *Règne Animal*, 1st ed., **2** : 176 (descr., no species named) ; *Idem*, *ibid*, **4** : pl. 10, fig. 3 (Type : a species figured but not named) ; *Idem*, 1829, *Règne Animal*, 2nd ed., **2** : 321 (*P. tardoore* and *P. cayanus* listed) ; *Idem*, *ibid*, 1830, **3** : pl. 12, fig. 3 (repeat of 1st ed. plate, no species name).

(See Myers, 1956 for review of this synonymy.)

Cuvier (1817) referred to a single species from the " seas of America " but gave no species name. The figure in the 2nd edition of the *Règne Animal* is the same as that in the 1st edition. In the 2nd edition (1829), Cuvier named two species, the Indian Ocean *P. tardoore* and the Atlantic *P. cayanus* ; the figure must, therefore, refer to the latter, and *P. cayanus* can be taken as type of *Pristigaster*.

Cuvier distinguished this genus by the absence of pelvic fins, the very deep and compressed body, the strongly denticulated belly and the herring-like jaws. Thus, his definition did not exclude *Opisthopterus* (i.e. Russell's *Tardoore*), and Valenciennes likewise combined Indo-Pacific and Atlantic species. Gill (1861) finally proposed *Opisthopterus* for the Indo-Pacific species, thereby restricting *Pristigaster* to the New World. A single species of *Pristigaster* is currently recognized (Hildebrand, 1964).

62. *Pristigaster cayanus* Cuvier, 1829
= *Pristigaster cayana* Cuvier, 1829

Pristigaster Cuvier, 1817, *Règne Animal*, 1st ed., **2** : 176 ; *Idem*, *ibid*, **4** : pl. 10, fig. 3 (no species name given) ; *Idem*, 1830, *Règne Animal*, 2nd ed., **3** : pl. 12, fig. 3 (same plate, still no species name).

Pristigaster triangularis Stark, 1828, *Elements Nat. Hist.*, **1** : 408 (on Cuvier, 1817, pl. 10, fig. 3).
Pristigaster cayanus Cuvier, 1829, *Règne Animal*, 2nd ed., **2** : 321 (name only) ; Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 334, pl. 597 (description on supposed holotype).

TYPE MATERIAL. MNHN. 3699, 1 fish, 87.7 mm. S.L., *ex* Cayenne, coll. Leblond.

Bertin (1940) listed this specimen as the figured holotype, and its type status is accepted here (see below).

DESCRIPTION. *Holotype*, a fish of 87.7 mm. S.L. (112.4 mm. tot.l., mouth slightly open), *ex* Cayenne (French Guiana), coll. Leblond, in fair condition but right flank cut horizontally from pectoral base and with a vertical split, gill arches missing, tip of upper caudal lobe damaged, MNHN. 3699.

Br.St. 6, D ii 13, P i 11, V (none), A iii 51, g.r. (dam.), scutes 32, scales (n.r.).

In percentages of standard length : body depth 56.7, head length 26.9 ; snout length 6.7, eye diameter 10.1, length of upper jaw 13.2, length of lower jaw 13.2 ; pectoral fin length 24.0, length of anal base 48.5 ; pre-dorsal distance 42.8, pre-anal distance 65.2.

Body highly compressed, very deep, ventral profile strongly convex, belly sharply keeled. Eye large, snout length less than eye diameter. Upper jaw with a single series of small teeth except at centre of jaw ; small teeth continued onto lower edge of maxilla ; maxilla not quite reaching to articulation of lower jaw ; two supra-maxillae present, the 1st (anterior) oval, the 2nd (posterior) with lower part of expanded portion larger than upper, the expanded portion gradually tapering to

form a slender anterior shaft. A few minute teeth at symphysis of lower jaw. Frontals with a pair of ridges on each side, merging to form a single ridge on each side behind the eyes ; no striated cuneiform fronto-parietal area.

Pseudobranch present, exposed, its length a little less than $\frac{1}{2}$ eye diameter. All gill arches removed. Gill opening with a cleithral lobe present.

Dorsal fin preceded by 5 spine-like projections (distal tips of pre-dorsal bones) ; dorsal origin nearer to snout tip than to caudal base by 2 eye diameters. Pectoral tips damaged. Pelvic fins absent. Anal fin origin equidistant between caudal base and eye centre.

COLOUR : upper $\frac{1}{2}$ brown, rest of flanks silvery. Fins hyaline.

Note. Valenciennes (1847 : 334) re-described the same specimen that Cuvier had examined, and this is the only case (amongst the clupeoids) of an extant Cuvier type. The figure given by Valenciennes matches the present specimen ; Cuvier's figure (see Plate 6c), although reduced to $\frac{2}{3}$ natural size and a rather crude drawing, was almost certainly made from the same specimen. Valenciennes' artist (Diekmann) does not show the pre-dorsal spine-like projections which are emphasized in Cuvier's figure, possibly believing them an artifact of poor preservation ; Valenciennes specifically mentions them in the text, however. Both the Cuvier and the Valenciennes drawings show a spurious lateral line.

The pre-dorsal bones of percoid fishes were discussed by Lavett Smith & Bailey (1961). They have not yet been studied in clupeoid fishes, but their number may have some phyletic importance. I have found 25 in *Dussumieria acuta*, 17 in *Clupea harengus*, 10 in *Cynothrissa ansorgii*, 5 in *Pristigaster cayana* and 3-4 in *Coilia clupeoides*. The series is suggestive of a reduction in specialized forms. Bertin & Arambourg (1958 : 2227) cite *Pristigaster* as a modern clupeid with pre-dorsal scutes, possibly through a misinterpretation of the pre-dorsal bones. Signeux (1964), however, found true pre-dorsal scutes in the Cretaceous *Gasteroclupea branisai* Signeux, a species with a great superficial resemblance to *Pristigaster* but whose large and medially united parietals are more suggestive of the fossil "double-armoured" herrings than of modern clupeids.

Cuvier (1829) gave in a footnote the name "*Pr. cayanus*, N., Esp. nouv. " without any description beyond that of the genus. Cuvier's figure (published the following year) refers back to the text and is un-named, but the text also contains reference to "*Pr. tardoore*, N., Russel, 193 ". Thus the name *P. cayanus* could be judged a *nomen nudum*. However, the text in the 1st edition of the *Règne Animal* refers only to an American species, and so must the figure in that edition. Since the figure in the 2nd edition is a copy of that in the 1st, it too must refer to an American species, i.e. to *P. cayanus*. Strictly speaking, there is no bibliographic reference with the name *P. cayanus* to the already published figure of the first edition, and Article (16a) of the International Code is not satisfied. But no other interpretation is possible and the identity of the species cannot be questioned now that Cuvier's holotype is positively identified as such. Also, as pointed out ingeniously by Myers (1956), there is no absolute demarcation between what are specific and what are generic characters, particularly in the case of the first description of a monotypic genus. Thus Cuvier's original generic diagnosis can equally be held to be a species diagnosis.

The situation was further complicated by Stark (1828), who gave the name *Pristigaster triangularis* to Cuvier's original (1817) figure labelled "*Pristigastre*". The appearance of new names in popular or student books of that period is not unusual, and occasionally these lead to systematic difficulties (e.g. Shaw & Nodder's *Xiphias platypterus*—see Whitehead 1964d). In the present case, however, the name *P. triangularis* does not appear to have been used subsequently and is clearly a *nomen oblitum*. Myers (1956) has commented on another early name, *Pristigaster americanus* Guérin-Méneville, 1844, but the name is of later date than those of Cuvier or Stark, and it too has been generally overlooked.

63. *Pristigaster phaeton* Valenciennes, 1847
= *Pristigaster cayana* Cuvier, 1829

Pristigaster phaeton Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 338 (Amazon ; 1 fish, 4½ inches ; Castelnau) ; Castelnau, 1855, *Anim. Nouv. Rares Amer. Sud, Poiss.* : 57, pl. 28, fig. 3 (type figured).

TYPE MATERIAL. *MNHN*. 3700, 1 fish 94.2 mm. S.L., *ex* Amazon, coll. Castelnau. This specimen is clearly the holotype.

DESCRIPTION. *Holotype*, a fish of 94.2 mm. S.L., *ex* Amazon, coll. Castelnau, no scales but otherwise in good condition, *MNHN*. 3700.

Br.St. 6, D iii 13, P i 11, V (absent), A ii 49, g.r. 11 + 20, scutes 33 (last one minute).

In percentages of standard length : body depth (maximum) 52.5, head length 24.7 ; snout length 6.6, eye diameter 9.9, length of upper jaw 13.6, length of lower jaw 14.2 ; pectoral fin length 23.7, length of anal fin base 51.0 ; pre-dorsal distance 41.7, pre-anal distance 63.0.

Body highly compressed, chest and abdomen strongly convex, scutes forming trenchant keel. Snout a little less than eye diameter. Lower jaw prominent, a few minute teeth at symphysis. Pre-maxillae with a single series of conical teeth but median edentulous area ; small teeth continued onto lower edge of maxilla ; two supra-maxillae present, the 1st (anterior) oval, the 2nd (posterior) with lower part of expanded portion larger than upper, the expanded portion tapering anteriorly to form a slender shaft (Figure 9c). Frontals with a pair of ridges on each side, merging to form a single ridge on each side behind the eyes ; no striated cuneiform fronto-parietal areas.

Pseudobranch present, exposed, its length almost ½ eye diameter. Gillrakers moderately slender, 1¾ length of gill filaments, almost ½ eye diameter ; gillrakers present on posterior face of 3rd epibranchial. Gill opening with cleithral lobe present.

Dorsal fin preceded by 5 spine-like projections (distal tips of pre-dorsal bones) ; dorsal origin nearer to snout tip than to caudal base by 2 eye diameters. Anal fin origin equidistant between caudal base and anterior border of eye, lying below last dorsal ray.

COLOUR : upper ⅓ brown, remainder of flanks silvery. Fins hyaline.

Note. Valenciennes distinguished *P. phaeton* from *P. cayana* and *P. martii* Agassiz (his third species of *Pristigaster*) by its more elongate body, but the difference found here is slight (*P. phaeton* depth 52.5 per cent. ; *P. cayana* 56.7 per cent.). He distinguished it from *P. martii* by its longer anal fin (51 rays ; 46 or 47 stated for *P. martii*). Hildebrand (1964) synonymized all three species and gave a range of 46–55 anal rays, a not unlikely range in this subfamily.

Agassiz proposed the name *P. martii* in 1829, but there appears to be no way of knowing whether Agassiz's name predates Cuvier's *cayanus* or not. Myers (1956) has reviewed this question and, rightly in my opinion, retained the Cuvier name, as did Günther (1868 : 463) and most later authors.

ODONTOGNATHUS Lacepède, 1800

Odontognathus Lacepède, 1800, *Hist. Nat. Poiss.*, **2** : 220 (Type : *Odontognathus mucronatus* Lacepède).

Gnathobolus Bloch & Schneider, 1801, *Syst. Ichthyol.*, **2** : 556 (Type : *Odontognathus mucronatus* Lacepède).

While Valenciennes' generic system faltered by its over-emphasis on teeth, Lacepède's system foundered on the exploitation of another character—fins. So it was that Lacepède's *Odontognathus*, a fairly easily recognized clupeid but one lacking pelvic fins, came to be placed between *Regalecus* and *Muraena* amongst the "Poissons Apodes", three volumes before the rest of the clupeoids. Cuvier (1817) later restored *Odontognathus* to its place amongst the clupeoids.

The single fish examined by Lacepède, one of the very few Lacepède clupeoid specimens still extant, was even then badly damaged. The maxillae were apparently bent forward like a pair of horns. Lacepède's (1800 : 221) description of this

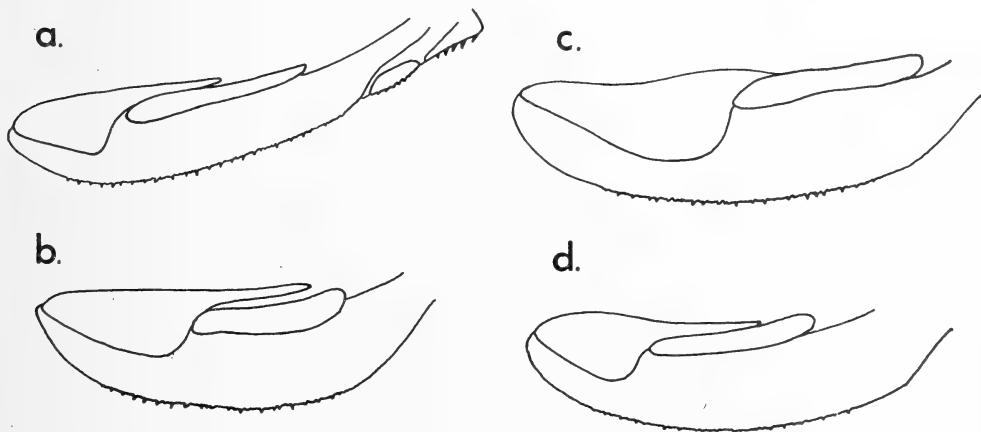


FIG. 8. Upper jaw (right side) showing shape of supra-maxillae. a. *Pellona castelnaeana* lectotype (= *P. castelnaeana*), 380 mm. S.L. (MNHN. 3705). b. *Pellona novacula* holotype (= *Ilisha elongata*), 131.7 mm. S.L. (MNHN. 3704). c. *Pellona leschenaulti* holotype (= *I. elongata*), 360 mm. S.L. (MNHN. 3435). d. *Pellona dussumieri* lectotype (= *I. megaloptera*), 260 mm. S.L. (MNHN. 3708).

condition led to the proposal of a new name, *Gnathobolus*, by Bloch & Schneider (1801 : 556). Cuvier (1817 : 176) accepted this and used the name *Gnathobolus*, but later (Cuvier, 1829 : 321), having presumably examined the specimen, he recognized that the jaw position was accidental, although he continued to cite the genus as *Gnathobolus*.

Valenciennes (1848 : 87) criticized Lacepède's general treatment of the genus, and added somewhat pointedly that, in spite of a description "orné . . . de tous les charmes de son style", Lacepède failed to make the obvious deduction that the two "horns" were in fact the maxillae. Valenciennes also used the name *Gnathobolus*. He decided to place this genus after the anchovies, but conceded that on jaw characters it could well be placed with the *Pristigastres*, as Cuvier had done.

The genus *Odontognathus* contains two Western Atlantic species, *O. mucronatus* and *O. compressus* Meek & Hildebrand; and one Eastern Pacific species, *O. panamensis* (Steindachner). *O. mucronatus* can be distinguished by its short scuteless area below the pectoral fin base and absence of serrated margins to the posterior scutes. Hildebrand (1964) recorded the scuteless area as an abnormality, but this is not the case (Berry, 1964c; and personal observation).

64. *Odontognathus mucronatus* Lacepède, 1800
= *Odontognathus mucronatus* Lacepède, 1800

Odontognathus mucronatus Lacepède, 1800, *Hist. Nat. Poiss.*, **2** : 220 (Cayenne; 1 fish; D 6 or 7, P 12, A 80, scutes 8 + 28).

Gnathobolus mucronatus : Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 91, pl. 611 (redescription of type).

TYPE MATERIAL. MNHN. 3621, 1 fish, 116.0 mm. S.L., ex Cayenne, coll. Leblond.

This is the only extant clupeoid specimen for which there is definite evidence that it was examined by Lacepède, Cuvier and finally by Valenciennes.

DESCRIPTION. *Holotype*, a fish of 116.0 mm. S.L., ex Cayenne (French Guiana), coll. Leblond, in very poor condition, right side of body dissected, most of back and belly missing, dorsal fin absent, part of anal fin damaged, MNHN. 3621.

Br.St. (n.r.), D (damaged), P 1 11, V (absent), A 42 + (damaged), g.r. 7 + 1 + 23, scutes 8 + 2 (2 missing here) 6 + (remainder damaged).

In percentages of standard length : body depth 22.8 (approx.), head length 18.3; snout length 4.4, eye diameter 5.2, length of upper jaw 12.4, length of lower jaw 7.8; pectoral fin length 18.1 (undamaged), length of anal base 19.4 (incomplete); pre-dorsal and pre-anal (indet.).

Body highly compressed, belly sharply keeled with a scuteless area below pectoral fin base (not due to damage). Lower jaw strongly projecting. Upper jaw with series of fine teeth on pre-maxillae and lower edges of maxillae; maxilla reaching to beyond posterior border of eye, progressively expanded to tip of 2nd supra-maxilla, then narrowing sharply and continuing as slender arm with blunt tip; no 1st (anterior) supra-maxilla (both sides), 2nd (posterior) supra-maxilla of "*Harengula*" shape (Figure 9b).

Pseudobranch present, exposed, its length $\frac{1}{2}$ eye diameter. Gillrakers moderately slender, $1\frac{1}{3}$ times length of corresponding gill filaments, a little over $\frac{1}{3}$ eye diameter. Gill opening with cleithral lobe present.

Dorsal fin missing (damaged). Pelvic fins absent. Anal fin badly damaged.

COLOUR : body dark brown, visceral region silver, remaining fins hyaline.

Note. Lacepède gave dorsal, anal and scute counts (6 or 7, 80 and 8 + 28 respectively), of which the dorsal is lower and the scute count higher than are given by Hildebrand (1964) (10–12, 79 or 80, 21 or 22, respectively). The scuteless area below the pectorals and the absence of serrated scutes place this specimen in *O. mucronatus* as currently defined.

PELLONA Valenciennes, 1847

Pellona Valenciennes, 1847, Hist. Nat. Poiss., 20 : 300 (Type : *Pellona orbignyana* Valenciennes, designated by Gill, 1861, *Proc. Acad. nat. Sci. Philad.* : 38).

Neosteus Norman, 1923, *Ann. Mag. nat. Hist.*, (9) **11** : 17 (Type : *Pellona ditchela* Valenciennes by subsequent designation of Norman, *Zool. Rec. Pisces* for 1923 : 25).

Norman (1923) proposed the name *Neosteus* for those *Ilisha*-like species possessing a toothed hypo-maxilla. Fowler (1941 : 648), however, showed that *Neosteus* must be replaced by *Pellona*, Norman having apparently overlooked Gill's type designation. Myers (1950) found no difference between *Pellona* and *Ilisha* other than the presence or absence of the hypo-maxilla, and he mentioned an Amazon specimen with the bone present on one side only. Thus Myers concurred with Hildebrand (1964) in recognizing only a single genus, *Ilisha*.

The presence or absence of a hypo-maxilla certainly reinforces a fundamental geographical discontinuity between two other clupeid genera, *Harengula* (with) and *Herklotsichthys* (without) (Berry, 1964a, b). The relative importance of this bone is also suggested by the comparative rarity of its appearance amongst both living and fossil clupeids, in spite of the fairly common modifications in shape and numbers of supplementary jaw bones found elsewhere in the clupeoids. For this reason, the distinction between *Ilisha* and *Pellona* is retained for the present. It is perhaps unfortunate that this character does not reinforce the general clupeoid division between New World and Old World pristigasterine genera : the Indo-Pacific and West African *Ilisha* has a single New World species, *I. amazonica*, while the American *Pellona* has one Indo-Pacific species, *P. ditchela*. No one has yet succeeded in resolving this, although Tucker (1954) hinted that it might be possible in *Ilisha*. Berry (*in litt.*) has pointed out that the types of *Harengula spilura* Guichenot, 1863 from Reunion I. in the Indian Ocean, possess a toothed hypo-maxilla and are thus members of the otherwise New World genus *Harengula*. No further records have come to light and the provenance of the specimens is at least open to suspicion.

Lacepède (1803 : 470) recorded a single species now recognized as a member of *Ilisha*. Cuvier did the same (in the 1st edition of the *Règne Animal* only), and also listed *Clupea melastoma* Bl. & Schn. (now a *nomen oblitum* but = *Pellona ditchela*).

It is indicative of the enormous increase in the Paris collections after Lacepède wrote, that Valenciennes was able to give descriptions (mainly from specimens) of no less than 16 species of *Pellona* and *Ilisha*, placing all in his genus *Pellona*. Valenciennes mentions teeth (as in the Harengules), but with evident relief turns to other characters, defining the genus as containing species with compressed bodies, long anal fins, pelvic fins set in front of the dorsal origin, and the belly as strongly denticulated as in his species of *Pristigaster*.

65. *Pristigaster flavipinnis* Valenciennes, 1837
= *Pellona flavipinnis* (Valenciennes, 1837)

Pristigaster flavipinnis Valenciennes, 1837, in d'Orbigny, *Voy. Amer. Merid., Poiss., Atlas*: pl. 10, fig. 2 (figure only, subsequently identified as a d'Orbigny specimen from Buenos Aires—see below); Valenciennes, 1847, *ibid.*, 5 (2): 8.

Figure. Valenciennes' coloured drawing (by Oudert—shown here, Plate 7a), is of a high standard and includes accurate details of the dermal head bones, jaws, etc., features which were often rather crudely drawn at that time. The figure is of a fish of 146 mm. S.L. (185 mm. total length), clearly a species of *Pellona* (toothed hypo-maxilla evident) and showing the following features:

1. Belly profile evenly convex, scutes prominent (20 + 13)
2. Pectoral fin reaching to pelvic fin base, but no pectoral axillary scale shown; upper rays of pectoral yellow
3. Anal fin with about iii 32 rays, its base 30.5 per cent of standard length
4. Caudal with outermost rays light brown; a diffuse light green vertical band across fin, the area in front cream coloured, the caudal lobes fawn.

IDENTIFICATION. *Pellona flavipinnis* closely resembles *P. castelnaeana*, but Norman (1923) and Hildebrand (1964) kept the two distinct, chiefly because of differences in gillraker number and the length of the pectoral axillary scale. Neither of these two characters can be checked in the figure of *P. flavipinnis*. Hildebrand (*loc. cit.*) added two further meristic differences (see below), which again cannot be checked, but he also noted that his two specimens of *P. flavipinnis* lacked the "dark spot on the lower lobe of the caudal" described in *P. castelnaeana* (by Valenciennes but not by Norman). This dark mark is most pronounced in the syntypes of *P. castelnaeana* (266 and 380 mm. S.L.) and in those specimens over 300 mm. S.L. in the British Museum, but is absent in smaller specimens. It is also absent in all the British Museum specimens of *P. flavipinnis* (largest 247 mm. S.L.) except for 7 small fishes (116–145 mm. S.L.) from Rosario. In the latter, the caudal lobes are dusky, with a distinct lighter band following the posterior border of the fin, the border itself again being dusky. This, however, is a slightly different pattern to that found in *P. castelnaeana* (see description of type below).

I conclude from this, that the caudal colouration of *P. castelnaeana* may be merely a characteristic of large adults over about 300 mm. S.L., and that Valenciennes' type of *P. flavipinnis* was perhaps too small (10½ inches described) to have shown it.

Conversely, this colouration may well be dependent on the fixation method and thus its absence in preserved material is inconclusive. In all other respects, the Valenciennes' figure of *P. flavipinnis* resembles *P. castelnaeana*, and the distinction between the two species must rest on differences found in subsequent material from the two type localities. As shown below, the rather scant material suggests that two species are involved.

Note. The name *flavipinnis* first appears in the caption to the drawing in d'Orbigny's Atlas to his South American travels. Sherborn & Griffin (1943) date the figure in question (plate 10, fig. 2) as 1837, although the text did not appear until 1847. Under Article 16 (a) of the International Code, the name *flavipinnis* is valid.

66. *Pellona orbignyana* Valenciennes, 1847
= *Pellona flavipinnis* (Valenciennes, 1837)

Pellona orbignyana Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 302 (Buenos Aires ; some fishes, to 10½ inches ; d'Orbigny).

TYPE MATERIAL. Bertin (1940) did not list any specimens of *P. orbignyana* and none were found in Paris, in spite of a thorough search.

Note. Norman (1923), in the only full review of the genus, based his description of *P. flavipinnis* on two specimens from the type locality, Buenos Aires (stated as 160 and 285 mm. tot. l., but this seems to refer to their fork length). Norman distinguished this species from the closely related *P. castelnaeana* Valenciennes by its higher number of gillrakers (30–31 ; cf. 23–26) and shorter pectoral axillary scale (not half length of pectoral ; cf. more than half). Hildebrand (1964), with two Buenos Aires specimens of *P. flavipinnis* (173 and 187 mm. S.L.) endorsed these differences and added three more : fewer rays in the dorsal fin (17–18 ; cf. 19–20), fewer anal rays (38–39 ; cf. 40–41) and a shorter anal base (28.2–29.0 per cent. of S.L. ; cf. 27.8–28.6 per cent.). Hildebrand had no *P. castelnaeana* specimens, however.

The distinction between these two species is discussed more fully under the next species, but the question is raised here in connection with the possibility of designating a neotype for *P. orbignyana*. The conclusion reached below is that the populations of *Pellona* at Buenos Aires (and Rosario) differ from those of *P. castelnaeana* of the Amazon and the Guianas only in having fewer gillrakers (12–28 ; cf. 29–31 on the lower arm of the 1st arch) and a slightly shorter pectoral axillary scale. With the rather few specimens available, and no large *P. flavipinnis*, this distinction should be accepted with caution. But since all the Buenos Aires material is so far consistent, designation of one of Norman's two specimens as neotype would be appropriate. Unfortunately, one of these is a juvenile (130 mm. S.L.) and the other unsuitable since it lacks gill arches on both sides. The remaining British Museum specimens are from Rosario, some miles up the river Plate. For the present, therefore, no type designation is made for *P. orbignyana*.

67. *Pellona castelnaeana* Valenciennes, 1847
 = *Pellona castelnaeana* Valenciennes, 1847

Pellona castelnaeana Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 306 (Amazon mouth ; 2 fishes, 17 inches; Castelnau).

TYPE MATERIAL. *MNHN*. 3705, 1 fish, 380 mm. S.L., ex Amazon mouth, coll. Castelnau (1847).

MNHN. 3706, 1 fish, 266 mm. S.L., ex Amazon mouth, coll. Castelnau (1847).

The largest of these two syntypes is chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 380 mm. S.L., ex Amazon mouth, coll. Castelnau, scales mostly gone anteriorly, a horizontal slit along left flank from pectoral base to above anal origin, otherwise in good condition, *MNHN*. 3705.

Br.St. 6, D iii 16, P i 15, V i 6 (both sides), A iii 35, g.r. 10 + 14 (10 + 13 in paralectotype), scutes 23 + 10 (24 + 9 in paralectotype).

In percentages of standard length : body depth 29.0, head length 25.2 ; snout length 6.2, eye diameter 4.3, length of upper jaw 13.6, length of lower jaw 14.0 ; pectoral fin length 19.2, pelvic fin length 6.5, length of anal base 28.8 ; pre-dorsal distance 51.5, pre-pelvic distance 45.5, pre-anal distance 69.4.

Body compressed, belly sharply keeled, body depth a little greater than head length. Snout longer than eye diameter. Lower jaw projecting strongly, four small conical teeth on each side of dentary symphysis. Pre-maxillae with a single series of short conical teeth, but with median edentulous area ; toothed hypo-maxillae present ; maxilla with denticulated lower edge ; two supra-maxillae present, the 1st (anterior) elongate, about 6 times as long as deep, the 2nd (posterior) with only the lower part of expanded portion enlarged (Figure 8a). Frontals with a single longitudinal ridge on either side, not converging posteriorly, with no cuneiform striated fronto-parietal areas ; a single short longitudinal ridge on supra-occipital.

Pseudobranchiae present, exposed, rather small, about $\frac{2}{3}$ of eye diameter. Gill-rakers short and stout, becoming mere stumps anteriorly (especially Nos. 12, 13 and 14) ; longest raker $\frac{3}{4}$ length of corresponding gill filaments ; no rakers present on posterior face of 3rd epibranchial. Gill filaments equal to eye diameter, inner and outer hemibranchs equal. Base of isthmus with a fleshy lobe on each side, folded upwards.

Dorsal fin origin about equidistant between snout and caudal base ; a low scaly sheath at base of fin. Pectoral fin reaching to pelvic base ; axillary scale present, 1.42 times in length of 1st pectoral ray. Pelvic fin base nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter ; axillary scale present, 1.27 times in length of fin. Anal fin origin nearer to caudal base than to pectoral base by 1 eye diameter.

Scales with a single principal vertical striation on exposed portion, and many faint curved striae anterior to this ; minute scales over entire caudal fin.

COLOUR : body grey-brown, but golden where scales retained ; back slightly darker. Outer rays of caudal light coloured, but rest of fin dark brown except for hind margin ; the contrast between the lighter and darker areas especially pronounced on lower lobe.

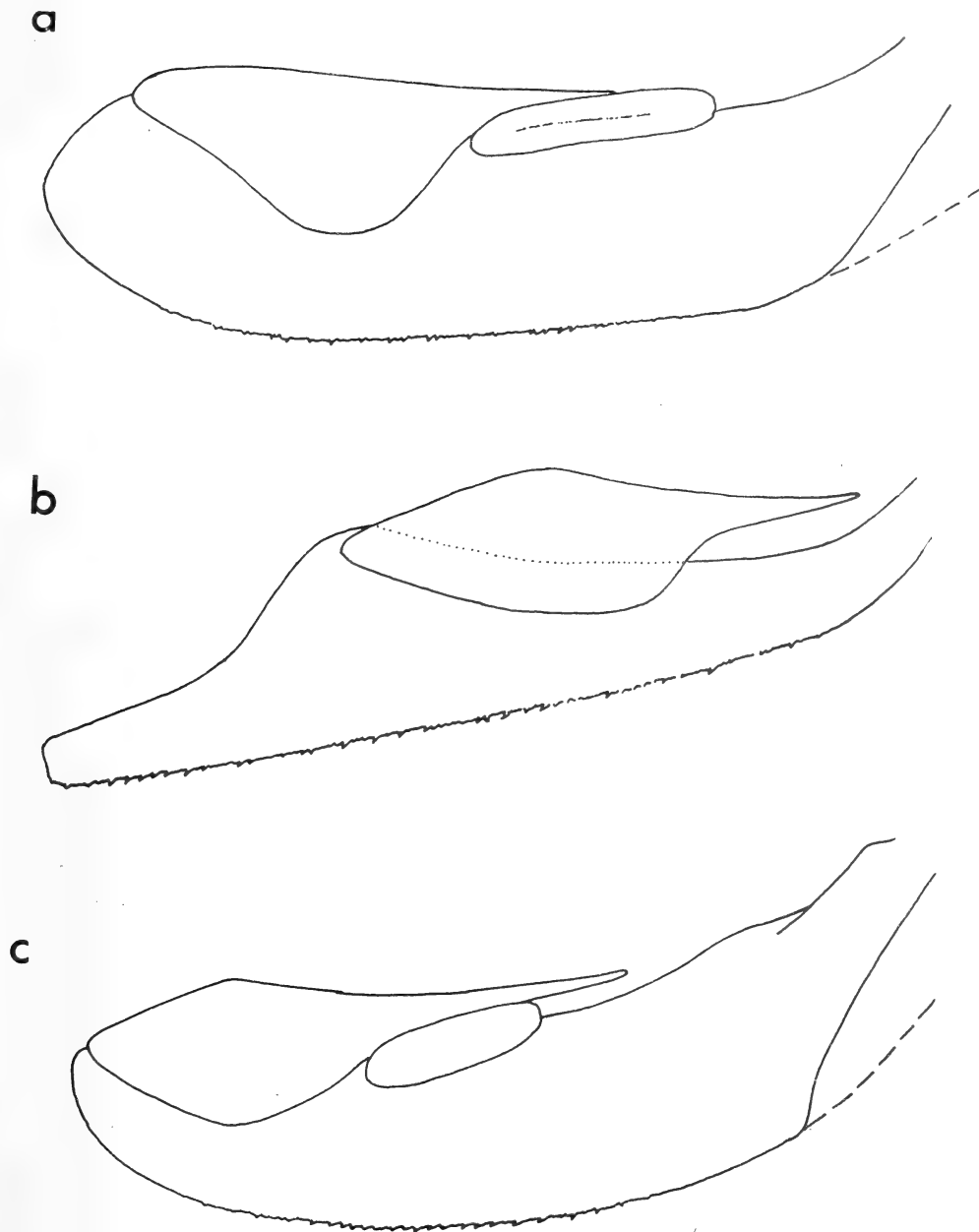


FIG. 9. Upper jaw (right side) showing shape of supra-maxillae. a. *Pristigaster tardoore* putative neotype (= *Opisthopecterus tardoore*), 139.1 mm. S.L. (MNHN. 1688). b. *Odontognathus mucronatus* holotype, 116.0 mm. S.L. (MNHN. 3621). c. *Pristigaster phaeton* holotype (= *Pristigaster cayana*) 94.2 mm. S.L. (MNHN. 3700).

Note. The British Museum specimens of *P. castelnaeana* have been compared with those of *P. flavipinnis* in respect to the four characters listed by Norman and Hildebrand (see above), with the following result :—

P. flavipinnis

		S.L.	g.r.	P. length		
				axil l.	D	A
Buenos Aires	{ BMNH.1878.5.16.1	247	—	3.0	iii 15	iii 35
	{ BMNH.1878.5.16.2	130	29	2.5	iv 14	iii 36
Rosario	{ BMNH.1965.9.8.28	250	31	2.5	iv 14	iv 31
	{ BMNH.1965.9.8.22-27	114-145	29-31	2.3-2.8	{ iii 14(5) iii 15(1) iii 16(1)	{ iv 34(2) iv 35(4) iv 36(1)

P. castelnaeana

Amazon	{ BMNH.1925.10.28.3	470	13	1.5	iii 14	iii 35
	{ BMNH.1925.10.28.4	365	12	1.6	iii 15	iii 34
Brit. Guiana	{ BMNH.1932.11.10.1	300	25	1.8	iv 16	iii 36
	{ BMNH.1932.11.10.2	—	—	—	iii 16	iii 39
Amazon	BMNH.1929.11.18.2	305	25	1.8	iv 16	iii 38
Amazon	BMNH.1869.5.21.51	260	28	2.1	iii 16	—
Surinam	BMNH.1843.6.22.107	240	25	1.8	iii 18	iv 37
Brit. Guiana	BMNH.1961.8.31.60	176	24	2.0	iii 17	iii 38
Dutch Guiana	BMNH.1936.5.6.1	197	25	2.1	iii 17	iii 40
SYNTYPES, <i>ex</i> Amazon	{ MNHN.3705	380	14	1.4	iii 16	iii 35
	{ MNHN.3706	266	13	—	—	—

- a. *Gillrakers* : the tendency for regression in very large adults may occur also in *P. flavipinnis*. Up to 300 mm S.L., *P. flavipinnis* has 29-31 rakers, and and *P. castelnaeana* 25-28 (except in smaller syntype).
- b. *Pectoral axillary scale* : this scale is longer in *P. castelnaeana* ; it shows signs of becoming even shorter relative to the fin in *P. flavipinnis*.
- c. *Dorsal rays* : a tendency to fewer rays in *P. flavipinnis*, but too much overlap between species for complete distinction to be made.
- d. *Anal rays* : as for dorsal rays.

The final diagnostic character suggested by Hildebrand, length of anal base, also shows considerable overlap between the two species. Future work may show the two species to be extreme forms of a single species.

68. *Pellona ditchela* Valenciennes, 1847
= *Pellona ditchela* Valenciennes, 1847

Clupea melastoma Bloch & Schneider, 1801, *Syst. Ich. Bloch.*, **2** : 427 (Coromandel coast) (*nomen oblitum*).

Pellona ditchela Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 314 (on *Ditchelee*, of Russell, 1803, *Fishes of Coromandel*, **2** : 72, pl. 188).

Valenciennes had no specimens of *P. ditchela* and merely identified Russell's *Ditchelee* as a member of his genus *Pellona* (i.e. including *Ilisha*). Although the

species is well known and is considered the only representative of *Pellona* in the Indo-Pacific, the provision of a neotype would be an advantage for future work on this genus. There is no suitable material in Paris, however, and the Indian specimens in the British Museum are both poorly preserved and from localities some distance from Vizagapatnam.

IDENTIFICATION. Russell's figures show a strong tendency towards a formalised and ornamental interpretation of many of those features now recognized as being of diagnostic value. Details of jaws and dermal head bones have suffered particularly. The drawing of *Ditchelee* is no exception (shown here, Plate 7b), but the following features identify the drawing as representing a species of *Pellona* :—

1. *Hypo-maxilla* : a small bulge in the line of the jaw indicates the presence of a hypo-maxilla, although this bone is not shown as toothed (minute teeth in specimens).
2. *Anal fin* : long, 38 rays shown (40 in text).
3. *Pelvic fins* : small, the base before dorsal origin ; (V 7 in text).
4. *Lower jaw* : strongly projecting.

Prior to Norman's revision, many authors accepted *Pellona hoevenii* Bleeker as a second Indo-Pacific species. In the absence of a type for *P. ditchela* and on described characters, there is no reason to separate the nominal *P. hoevenii* from *P. ditchela* (see also Whitehead, *et alii*, 1966).

Note. Norman (1923) and Fowler (1941 : 648) both tentatively identified *Clupea melastoma* Bloch & Schneider with *Pellona ditchela*. As shown elsewhere (Whitehead *et alii*, *loc. cit.*), *C. melastoma* is almost certainly a senior synonym of *P. ditchela*. Although Norman placed this name at the head of his synonymy, he referred to the species as *Neosteus ditchela*, and *Clupea melastoma* is now a *nomen oblitum*, not having been used as a senior synonym since Valenciennes (1847 : 308).

Cuvier (1829 : 319), in a footnote, equated the *Jangarloo* of Russell (1803 : 73 and pl. 191) with "*Clupea melastoma*, Schn. ". Russell's figure clearly shows a species of *Ilisha* not *Pellona*. However, Fowler (1941 : 659) wrongly interpreted Cuvier's action as the proposal of a Latin name for *Jangarloo*, and he thus used the name *Ilisha melastoma* (Cuvier) in preference to *I. megaloptera* (Swainson, 1839), overlooking the fact that Cuvier's "*melastoma*" would then become a junior primary homonym of *Clupea melastoma* Bloch & Schneider. The confusion seems to have arisen because Swainson's *Platyaster megalopterus* was also based on Russell's *Jangarloo*.

Pellona melastoma of Valenciennes, based on a single specimen of 9 inches, is *Ilisha megaloptera* (see p. 114).

ILISHA Richardson, 1846

Ilisha Richardson, 1846, *Ichthyol. China Japan* : 306 (Type : *Ilisha abnormis* Richardson = *Alosa elongata* Bennett—Whitehead, 1966a).

Like Cuvier, Valenciennes combined species of *Ilisha* with those of *Pellona*. Apart from the presence or absence of a toothed hypo-maxilla (curiously overlooked by the tooth-conscious Valenciennes), the two genera are indeed very similar.

Eleven of Valenciennes' species of *Pellona* belong in *Ilisha*, representing 6 species. The genus is badly in need of revision and the separation of the species primarily on scute and gillraker counts and on body depth is at present unsatisfactory (see note on *Pellona micropus*, for example). Norman (1923) used scale counts for a major division of his key, but this is impractical since scales are not always retained. Moreover, a number of nominal species lack type specimens, and subsequent descriptions may have contained mixed material; Norman's *I. africana*, for example, was based on an Indian Ocean specimen, an area in which this species does not occur (Tucker, 1954).

The key given by Whitehead, *et alii* (1966) was based mainly on a study of Bleeker's Indo-Malayan material. The Valenciennes types examined here are almost all from India and in many cases they cannot be accommodated in that key. But it would be unrealistic to attempt another key until much more material can be examined. The impression gained from the Bleeker and Valenciennes types is that many of Norman's 15 species will disappear into synonymy.

69. *Pellona iserti* Valenciennes, 1847
= *Ilisha africana* (Bloch, 1795)

Clupea africana Bloch, 1795, *Naturgesch. Auslând. Fische*, **9** : 45, pl. 407 (Accra); Cuvier, 1817, *Règne Animal*, 1st ed., **2** : 174.

Clupanodon africanus Lacepède, 1803, *Hist. Nat. Poiss.*, **5** : 469, 471.

Pellona iserti Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 307 (Acara, Guinea coast; ? some fishes; Isert).

TYPE MATERIAL. In his description, Valenciennes quotes Bloch's finray counts, suggesting that he himself had no specimens. Bertin (1940) does not list specimens and none were found in spite of a careful search. The statement by Valenciennes that Bloch's description (of *Clupea africana*) has some affinities with the species "que nous venons décrire d'après nature" suggests that Dr. Isert, who collected specimens, sent only a description or figure to Valenciennes.

A neotype is unnecessary for this nominal species. Valenciennes placed *C. africana* Bloch in his synonymy of *P. iserti*, distinguishing his species solely by discrepancies between it and Bloch's figure. The latter is, however, a fair representation of this West African *Ilisha*, the sole representative of the *Pristigasterinae* in the Eastern Atlantic.

IDENTIFICATION. Tucker (1954) reviewed the synonymy of *I. africana* and recognized a single West African species, of which the following are synonyms,

Pellona gabonica Duméril, 1858

Pristigaster dolloi Boulenger, 1902

Ilisha melanota Derscheid, 1924

I have examined the types of these and can confirm Tucker's conclusions. *Ilisha africana* of Norman (1923 : 4) was based on a single Indian Ocean specimen of *I. indica*; thus Norman's key is in this respect misleading, but until the genus has been revised, *I. africana* is perhaps best distinguished by its West African provenance. It appears to differ from the Indo-Pacific species keyed in Whitehead, *et alii*

(1966 : 93) by having a high pre-pelvic scute count but a low post-pelvic count (25-27 + 7-8).

Lacepède's *Clupea tropica* was based on *Clupea tropica* Linnaeus, a name proposed by Osbeck (1757) for a fish from Ascension I. Osbeck described a fish with a sharply serrated belly and a lower jaw longer than the upper, suggestive of *Ilisha africana*. But the long dorsal fin (26 rays), the scaled operculum and the wedge-shaped tail rule out a clupeoid. The serrated belly may have been a preservation artifact, the tips of the ribs projecting through the skin. This condition is commonly encountered in the non-scuted genus *Chirocentrus* (which does not occur in the Atlantic, however).

70. ***Pellona dussumieri*** Valenciennes, 1847
= ***Ilisha megaloptera*** (Swainson, 1839)

Platyaster macrophthalma Swainson, 1838, *Nat. Hist. Animals*, **1**: 278 (on *Jangarloo* of Russell, 1803, *Fishes of Coromandel*, **2** : 73, pl. 191) (*nomen oblitum*).

Platyaster megalopterus Swainson, 1839. *ibid*, **2** : 294 (on *Jangarloo*).

Pellona dussumieri Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 316, pl. 596 (Malabar, Coromandel and Bombay ; some fishes, to 1 foot ; Dussumier, also Roux).

TYPE MATERIAL. MNHN. 3708, 1 fish, 260 mm. S.L., ex Coromandel coast, coll. Dussumier (1830).

MNHN. 3707, 1 fish, 165.0 mm. S.L., ex Malabar coast, coll. Dussumier (1827).

MNHN. 3709, 1 fish, 204.0 mm. S.L., ex Bombay, coll. Dussumier (1830).

MNHN. 3936, 1 fish, ca. 255 mm. S.L., ex Bombay, coll. Roux [DRY SPECIMEN].

The first of these specimens is here chosen as lectotype. It is recommended as a suitable neotype for *Platyaster megalopterus* Swainson (see below).

DESCRIPTION. *Lectotype*, a fish of 260.0 mm. S.L. (328 mm. tot.l.), scales almost all gone, about two pre-pelvic scutes missing, otherwise in good condition, MNHN. 3708.

Br.St. 6, D iii 14, P i 16, V i 5, A iii 42, g.r. 9 + 19, scutes 20 [+ 2?] 1 + 9.

(Counts for MNHN. 3707 and 3709 respectively : A iii 49 and iii 47, g.r. 8 + 18 and 10 + 19, scutes 23 + 10 and 23 + 11.)

In percentages of standard length : body depth 32.4 (32.5 and 33.0 in MNHN. 3707 and 3709), head length 25.3 ; snout length 6.4, eye diameter 7.6, length of upper jaw 13.5, length of lower jaw 12.8 ; pectoral fin length 28.4, pelvic fin length 5.1, length of anal base 39.2 ; pre-dorsal distance 51.3, pre-pelvic distance 46.6, pre-anal distance 62.0.

Body compressed, belly keeled, body depth greater than head length. Snout a little shorter than eye diameter. Lower jaw strongly projecting, about two dozen small teeth at dentary symphysis. A few teeth on pre-maxillae ; entire lower edge of maxilla denticulated. Two supra-maxillae present, the 1st (anterior) slender, about 1½ times length of expanded portion of 2nd (posterior) supra-maxilla ; expanded portion of latter with ventral bulge, upper profile almost straight (Figure 8d).

Pseudobranch present, exposed, just under ½ eye diameter. Gillrakers moderate ; no mediopharyngobranchial.

Dorsal fin origin equidistant between snout tip and caudal base. Pectoral fin tips failing to reach pelvic base by ½ pupil diameter. Pelvic fins nearer to pectoral base

than anal origin by $\frac{1}{2}$ pupil diameter. Anal fin origin below 11th branched dorsal ray.

COLOUR : upper $\frac{1}{5}$ of body dark brown, remainder of flanks silvery.

IDENTIFICATION. This specimen has slightly more pre-pelvic scutes but otherwise resembles the lectotype of *Pellona russellii* Bleeker, which was identified as *Ilisha megaloptera* (Swainson) by Whitehead, *et alii* (1966). Günther (1868), Bleeker (1872), Norman (1923) and Fowler (1941) all considered *Pellona russellii* identical to Russell's *Jangarloo*, which was the basis of Swainson's *Platyaster megalopterus*.

The problem can only be resolved by the designation of a neotype for Swainson's *Platyaster megalopterus*, with which Valenciennes' *dussumieri* and Bleeker's *russellii* can be compared. In turn, this depends on an attempt to identify Russell's *Jangarloo* (shown here, Plate 8a). Russell (1803 : 73 and pl. 191) gave the following information :

Br.St. 6, D 17, P 17, V 6, A 43, C 22, scutes 17 + 11 (in figure, but ? 2 hidden by pelvic fin).

Body depth 31.8 per cent. of S.L. (in figure).

Anal origin behind vertical from last dorsal ray.

Following Norman's paper, *I. pristigastroides* and *I. sladeni* have the anal origin under the anterior part of the dorsal base. The deep-bodied *I. macrogaster* and *I. brachysoma* can be eliminated, as also the slender *I. elongata*, *I. kampeni* and *I. motius*. A rather higher total scute count is found in *I. xanthoptera* (37 in holotype) and *I. filigera* (34 in lectotype). Norman's *I. amblyuropterus* is a synonym of *I. pristigastroides* (Whitehead, *et alii*, 1966), while his *I. leschenaulti* and *I. novacula* are synonyms of *I. elongata* (see below).

Thus two candidates remain, both Swainson nominal species, *I. megaloptera* and *I. indica*. Neither has a type nor an adequate original description (scute and gillraker counts are ignored), so that Norman's separation of the two on scale counts is suspect (46-50 and 42-45 respectively). However, *I. indica* was described as having only 37 anal finrays and until this low count can be confirmed the species is kept separate (see below, p. 116).

Since Valenciennes largest specimen of *Pellona dussumieri*, chosen here as lectotype, came from the type locality of Swainson's *Platyaster megalopterus* (i.e. Russell's *Jangarloo*), the simplest solution would be to designate this specimen neotype of Swainson's species. Unless a real difference in scale counts can be upheld, *Ilisha indica* (Swainson) is probably a synonym, and Bleeker's *Pellona russellii* is probably the same species too.

Note. Valenciennes (1847 : 308) included *Pellona melastoma* in his list of species, based on a single specimen from Pondicherry collected by Bélanger. The following measurements were made on this specimen :

MNHN. 5149, 1 fish, 190.0 mm. S.L., ex Pondicherry, coll. Bélanger.

No hypo-maxilla ; anal origin behind vertical from last dorsal ray.

Body depth 32.8 per cent. of S.L.

Gillrakers 11 + 22 ; scutes 19 + 9.

The position of the anal fin, the lower scute count and the moderate body depth place this specimen in *I. megaloptera*. Valenciennes recorded the jaws as being

almost without teeth, and therefore identified the specimen with Bloch's *Clupea melastoma*, claiming that it was his only fish of which one could say "*dentibus mediis nullis*". In fact, Bloch's intention seems to have been to draw attention to the absence of teeth in the centre of the upper jaw, a characteristic of all species of *Ilisha*.

A further problem concerns the correct name for this species. Günther (1868) identified Russell's *Jangarloo* as *Pellona motius* (Ham. Buch.). Norman disagreed, keeping *Ilisha motius* separate and using Swainson's name *megalopterus*. Fowler (1941 : 659) completely confused the issue by heading his synonymy with "*Clupea melastoma* Cuvier, 1829" (supposedly based on *Jangarloo*), quite overlooking the fact that Cuvier himself attributed the name *melastoma* to Schneider. Earlier, however, Fowler (*loc. cit.* : 648) had rightly identified *Clupea melastoma* Bloch & Schneider as *Pellona ditchela* (see p. 111).

Clupanodon motius is here regarded as unidentifiable at present. Hamilton-Buchanan (1820 : 251) compared it with Russell's *Ditchelee* (i.e. *Pellona ditchela*), stating that it differed by lacking an indentation on the edge of the upper jaw and by possessing 43 not 40 anal rays. In these two characters, *C. motius* agrees with Russell's *Jangarloo*, and it is curious that Hamilton-Buchanan did not comment on this. Since *Pellona ditchela* has an anal count of only 33-37 according to Norman (1923), *Clupanodon motius* is most likely a species of *Ilisha*. Future work may show it to be the present species. Valenciennes had a single specimen which he referred to *Pellona motius* (MNHN. 5387, 1 fish, 51.5 mm. S.L., Ganges mouth). This fish has 21 + 11 scutes, 9 + 18 gillrakers and a body depth of 31.0 per cent. of S.L. It is here identified as *I. filigera*.

Günther (1868) completely ignored Swainson's *Platygaster megalopterus*, as also certain other Swainson clupeid names. Norman (1923) and Fowler (1941) resurrected only those names appearing in Vol. 2 of Swainson (1839), overlooking those in Vol. 1 (published a year earlier). On three occasions Swainson (1838) based a new clupeoid name on a Russell figure, and a year later proposed a new name, based on the same figure.

Russell	Swainson, Vol. 1 (1838)	Vol. 2 (1839)
191. <i>Jangarloo</i>	<i>Platygaster macrophthalma</i> Sw.	<i>P. megalopterus</i> Sw.
192. <i>Ditchoe</i>	<i>Platygaster verticalis</i> Sw.	<i>P. indicus</i> Sw.
193. <i>Tartoore</i> also,	<i>Pristogaster elongata</i> Sw.	<i>P. indicus</i> Sw.
199. <i>Wallah</i>	<i>Chirocentrus russellii</i> Sw.	<i>C. nudus</i> Sw.

The names from Vol. 1 are now *nomina oblita* and will be submitted to the International Commission under Article 23 (b).

71. ***Pellona micropus*** Valenciennes, 1847 = ***Ilisha micropus*** (Valenciennes, 1847)

Pellona micropus Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 320 (Coromandel coast and Bengal ; two fishes, 3½ inches ; Dussumier and Bélanger).

Pellona brachysoma Bleeker, 1852, *Verh. Bat. Gen.*, **24** : 22 (Batavia ; holotype redescribed in Whitehead, *et alii*, 1966).

TYPE MATERIAL. MNHN. 3711, 1 fish, 70.9 mm., S.L. ex Coromandel coast, coll. Dussumier (1830).

MNHN. 3712, 1 fish, 69.6 mm. S.L., *ex* Pondicherry, coll. Bélanger (1829).

The larger of the two syntypes is chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 70.9 mm. S.L., *ex* Coromandel coast, coll. Dussumier, in good condition, scales mostly retained, MNHN. 3711.

Br.St. 6, D iii 14, P i 15, V i 6 (both sides), A iii 37, g.r. 11 + 23 (11 + 28 in paralectotype), scutes 20 + 9 (20 + 8 in paralectotype).

In percentages of standard length : body depth 37.5, head length 27.1 ; snout length 6.5, eye diameter 10.1, length of upper jaw 12.8, length of lower jaw 14.0 ; pectoral fin length 20.0, pelvic fin length 5.8, length of anal base 32.5 ; pre-dorsal distance 47.9, pre-pelvic distance 49.5, pre-anal distance 63.5.

Body compressed, belly sharply keeled, body depth greater than head length. No hypo-maxilla ; two supra-maxillae, the 1st (anterior) narrow, the 2nd (posterior) with expanded portion enlarged ventrally but not dorsally. A pair of longitudinal frontal ridges diverging posteriorly, with 3-4 short longitudinal striae on the parietal region.

Pseudobranch present, exposed, about $\frac{1}{2}$ eye diameter. Gillrakers moderate, $1\frac{1}{4}$ times length of corresponding gill filaments, just less than $\frac{1}{2}$ eye diameter.

Dorsal fin origin nearer to snout tip than to caudal base by $\frac{1}{2}$ eye diameter. Pectoral fins almost reaching to pelvic base (probably to pelvic base in life). Pelvic fin base nearer to anal origin than to pectoral base by $\frac{1}{3}$ eye diameter. Anal fin base nearer to pectoral base than to caudal base by 1 eye diameter.

Scales with about 6 vertical, uninterrupted striae on unexposed portion.

COLOUR : upper $\frac{1}{3}$ brown, flanks silver, or gold where scale cover retained, fins hyaline.

IDENTIFICATION. In the key given by Whitehead, *et alii* (1966), two species were separated from the rest by their rather lower scute counts (18-19 + 7-9 ; *cf.* 22-27 + 10-14 in the remainder). The first, *I. brachysoma* (Blkr.), is a deep-bodied species (depth 40.4 per cent. of S.L.) with a high gillraker count (25). The second, *I. megaloptera* (i.e. Bleeker's *Pellona russellii*) is more slender (33.8 per cent. of S.L.) and has fewer gillrakers (21). The syntypes of *Pellona micropus* are in many ways intermediate between these two species although tending more towards the deeper-bodied *I. brachysoma*, with which they are identified for the moment. Larger collections may show that the deep-bodied fishes are merely an extreme variant of a widespread *I. megaloptera*.

72. *Pellona ditchoa* Valenciennes, 1847
= *Ilisha indica* (Swainson, 1839)

Platygaster verticalis Swainson, 1838, *Nat. Hist. Anim.*, **1** : 278 (on *Ditchoe* of Russell, 1803, *Fishes of Coromandel*, **2** : 74, pl. 192) (*nomen oblitum*).

Platygaster indicus Swainson, 1839, *Nat. Hist. Anim.*, **2** : 294 (on *Ditchoe*).

Pellona ditchoa Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 313 (on *Ditchoe*).

Swainson gave no reason for proposing a second name within the space of a year. The name *verticalis* has been ignored by all subsequent authors, but is listed in Sherborn's *Index Animalium*.

Valenciennes was evidently unaware that Swainson had already named Russell's *Ditchoee*. He himself had no specimens and merely enlarged on Russell's description.

IDENTIFICATION. Günther (1868 : 455) ignored both Swainson names, but Norman (1923) and Fowler (1941 : 652) gave the species as *I. indica* (Swainson), both overlooking the earlier name *verticalis*. They identified the species as close to *I. brachysoma* (Bleeker) (i.e. *I. micropus*) but having fewer anal finrays (38-41 ; cf. 45-49) and the anal origin below the last dorsal ray (just behind in *I. micropus*).

In the holotype of *I. brachysoma* there are 47 anal rays ; the anal origin is not behind the dorsal fin, however, but under the base of the 11th branched dorsal ray (Whitehead *et alii*, 1966). Russell (1803) gave an anal count of only 37 for his *Ditchoee*, which is a low count for a species of *Ilisha* and suggests *Pellona ditchela*. However, Russell's figure shows a short maxilla sharply bent halfway along its lower margin, a shape characteristic of *Ilisha micropus* (for example) but very different to the longer and more smoothly curved maxilla in *Pellona ditchela*.

Russell's anal count may have been too low (lowest anal count in British Museum specimens of *I. indica* is 40), but for the present the *Ditchoee*, *Ilisha indica*, can be kept distinct from *I. micropus* (see also discussion on p. 114 and p. 116). It would be an advantage to designate a neotype for *I. indica* but there are no suitable specimens either in Paris or in the British Museum.

73. ***Pellona filigera*** Valenciennes, 1847
= ***Ilisha filigera*** (Valenciennes, 1847)

Pellona filigera Valenciennes, 1847, *Hist. Nat. Poiss.*, **20** : 322 (coast of Coromandel, also Bombay ; 1 fish ?, 3½ inches ; Dussumier).

Pellona xanthoptera Bleeker, 1851, *Nat. Tijdschr. Ned. Ind.*, **2** : 439 (Sambas, Borneo ; holotype redescribed by Whitehead, *et alii*, 1966).

TYPE MATERIAL. MNHN. 3710, 2 fishes, 74.3-74.8 mm. S.L., *ex* Bombay, coll. Dussumier (1830).

The larger of the two is chosen as lectotype ; the smaller fish appears to be *I. micropus* (see below).

DESCRIPTION. *Lectotype*, a fish of 74.8 mm. S.L., *ex* Bombay, coll. Dussumier, in rather poor condition, scales gone, caudal tips frayed, MNHN. 3710.

Br.St. 6, D iii 17 (or iv 16), P i 17, V i 5 (both), A ii 49, g.r. 9 + 20, scutes 23 + 11.

In percentages of standard length : body depth 34.9, head length 24.7 ; snout length 6.7, eye diameter 9.6, upper jaw length 13.9, lower jaw length 13.9 ; pectoral fin length 18.7, pelvic fin length 4.7, length of anal fin base 33.8 ; pre-dorsal distance 52.5, pre-pelvic distance 44.9, pre-anal distance 59.8.

Body compressed, belly sharply keeled, body depth greater than head length. Snout a little shorter than eye diameter. Lower jaw projecting, small teeth present at dentary symphysis. Upper jaw with small conical teeth in a single series on pre-maxillae, the latter with a median edentulous portion. Maxilla denticulated along lower border ; two supra-maxillae, the 2nd (posterior) mainly expanded ventrally.

Pseudobranch present, exposed except for basal $\frac{1}{4}$, its length $\frac{1}{2}$ eye diameter. Gillrakers moderately slender, $1\frac{3}{4}$ times length of corresponding gill filaments, just less than $\frac{1}{2}$ eye diameter.

Dorsal fin origin equidistant between snout tip and caudal base. Pectoral fins long, reaching to halfway along pelvic fins. Pelvic fin base nearer to anal origin than to pectoral base by $\frac{1}{3}$ eye diameter. Anal fin origin below 8th branched dorsal ray, nearer to pectoral base than to caudal base by $1\frac{1}{2}$ eye diameters.

COLOUR : upper $\frac{1}{3}$ brown, remainder of flanks silvery. Fins hyaline.

IDENTIFICATION. The present specimen differs only slightly from the holotype of *Ilisha xanthoptera* (Bleeker). The following differences have been found :

	<i>I. filigera</i> (74.8 mm.)	<i>I. xanthoptera</i> (210 mm.)
body depth (% S.L.)	34.9	33.7
scutes	23 + 11	26 + 11
anal finrays	ii 49	iv 45
pelvic finrays	i 5	i 6
gillrakers (lower)	20	23
pelvic base	just nearer anal origin	just nearer pectoral base

These differences are no more than would be expected in fishes of different sizes and from different areas, and *I. xanthoptera* is accordingly placed in the synonymy of *I. filigera*.

The smaller of the two syntypes of *I. filigera* has 19 + 8 scutes and 12 + 27 gillrakers, which suggests the deep-bodied *I. micropus*. It is not known, however, to what extent and in what manner body depth alters during growth and for the moment this specimen must be placed rather tentatively in *I. micropus*.

74. *Pellona leschenaulti* Valenciennes, 1847 = *Ilisha elongata* (Bennett, 1830)

Alosa elongata Bennett, 1830, in *Mem. Life of Raffles* : 691 (Sumatra).

Pellona leschenaulti Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 311 (Pondichéry ; 1 fish, dry, 8 inches ; Leschenault).

TYPE MATERIAL. *MNHN*. 3435, 1 fish, 360 mm. S.L., ex Pondicherry, coll. Leschenault (1818) [DRY SPECIMEN].

DESCRIPTION. *Holotype*, a fish of 360 mm. S.L., ex Pondicherry, coll. Leschenault, a dry specimen in fair condition, scales gone, diagonal cut on right flank from above pelvic base to vent, caudal and pectoral tips damaged, *MNHN*. 3435.

Br.St. 6, D iii 14, P i 15, V i 6 (left damaged), A iii 46, g.r. 10 + 20, scutes 25 + 12.

In percentages of standard length : body depth 27.8, head length 23.2 ; snout length 6.6, eye diameter 5.9, length of upper jaw 12.2, length of lower jaw 12.3 ; pectoral fin length 15.7 (tip broken), pelvic fin length 4.0, length of anal fin base 32.7 ; pre-dorsal distance 54.0, pre-pelvic distance 45.7, pre-anal distance 65.0.

Body compressed, belly sharply keeled, body depth only slightly greater than head length. Lower jaw prominent, about 7 small teeth on each side of dentary symphysis. Upper jaw without a median notch, but this area edentulous, a few very small teeth present along remainder of pre-maxillae ; no hypo-maxillae ; maxilla denticulated along lower edge ; two supra-maxillae present, the 2nd

(posterior) expanded ventrally and tapering posteriorly (Figure 8c). Frontals with a pair of narrowly separated longitudinal ridges on each side, the inner pair continued posteriorly to hind end of skull, converging slightly but not meeting.

Pseudobranch present. Gillrakers equal in length to gill filaments, a little less than $\frac{1}{2}$ eye diameter.

Dorsal fin origin nearer to caudal base than to snout tip by 1 eye diameter. Pectoral tip damaged, but probably reaching pelvic base in life; axillary scale present, 2.66 times in length of fin. Pelvic fin base equidistant between pectoral base and anal origin. The latter very slightly nearer to caudal base than to pectoral base, lying below last dorsal ray.

COLOUR: upper $\frac{1}{4}$ of body brown, remainder of flank silvery. Fins hyaline.

IDENTIFICATION. If body depth is a stable character, then *I. elongata* can be distinguished from all other species by its more slender body. Also, the dorsal fin origin is set further back, being nearer to the caudal base than to the snout tip (equidistant or nearer snout tip in all the preceding species).

75. *Pellona grayana* Valenciennes, 1847
= *Ilisha elongata* (Bennett, 1830)

Clupea affinis Gray, 1830, *Illustr. Ind. Zool.*, 1: pl. 96, fig. 2 (India; on a Hardwicke drawing).
Pellona grayana Valenciennes, 1847, *Hist. Nat. Poiss.*, 20: 315 (no specimens; on Gray's *C. affinis*).

IDENTIFICATION. There appears to be no good reason why Valenciennes should propose another name for this fish. Günther (1868: 456), Norman (1923) and Fowler (1941: 661) all identified the Gray figure with *Ilisha elongata*.

Gray's (1830) figure of *Clupea affinis* (see Plate 8c) shows a fish of 273 mm. S.L. (possibly life size). The fish has the following proportions:—

(in per cent. of S.L.).			
body depth	31.7	pectoral length	17.9
head length	23.4	pelvic length	3.7
snout length	6.6	anal base l.	43.1
eye diameter	5.1		
	pre-dorsal distance	56.2	
	pre-pelvic distance	40.5	
	pre-anal distance	61.4	

The body depth is greater than is known in *I. elongata*, e.g.

<i>Alosa elongata</i> Benn. Holotype	26.3% (BMNH. specimen)
<i>Ilisha abnormis</i> Rich. Holotype	25.8% (Whitehead, 1966a)
<i>Pellona vimbelli</i> Val. Holotype	27.6% (see p. 120)
<i>Pellona schlegelii</i> Blkr. Holotype	27.4% (Whitehead, <i>et alii</i> , 1966a)
<i>Pristigaster sinensis</i> Sauv. Holotype	28.5% (MNHN. specimen)
<i>Pellona novacula</i> Val. Holotype	24.2% (see p. 121)

On the other hand, the large and rather deep maxilla, and the position of the dorsal fin origin well back from the midpoint of the body, both strongly suggest *Ilisha elongata*. It must be presumed that the drawing was a little inaccurate (a reduction of 7 mm. in the depth of the drawing would bring the depth below 30 per cent. of S.L.).

For the dating of this Gray illustration, often cited as 1835, I have followed Sawyer (1953) (received by the Linnean or E. India Company libraries on July 15th, 1830). The Memoires of the Life of Raffles, in which Bennett's name *Alosa elongata* appears, is merely dated 1830 on the title page. Under Article 21 (b) (ii) of the Code, Bennett's name should date from December 31st, 1830, giving *Clupea affinis* Gray priority. But Sherborn (1922) dates it as Feb. 1830, so the more commonly used Bennett name can be retained.

76. *Pellona vimbella* Valenciennes, 1847
= *Ilisha elongata* (Bennett, 1830)

Pellona vimbella Valenciennes, 1847, *Hist. Nat. Poiss.*, **20**: 317 (Macao; 1 fish, no size; Eydoux).

TYPE MATERIAL. MNHN. 5148, 1 fish, 248 mm. S.L., ex Macao, coll. Eydoux (1839).

DESCRIPTION. *Holotype*, a fish of 248 mm. S.L., ex Macao, coll. Eydoux, scales gone, dorsal, pelvic and pectoral tips broken, otherwise in good condition, MNHN. 5148.

Br.St. 6, D iv 14, P i 16, V i 6, A iv 46, g.r. 11 + 23, scutes 26 + 13.

In percentages of standard length: body depth 27.6, head length 23.6; snout length (n.r.), eye diameter (n.r.), length of upper jaw 12.2, length of lower jaw 12.2; pectoral fin length 10.1 (tip broken), pelvic fin length 3.0 (tip broken), length of anal fin base 38.5; pre-dorsal distance 51.3, pre-pelvic distance 42.4, pre-anal distance 58.8.

Body compressed, belly sharply keeled, body depth a little greater than head length. Lower jaw strongly projecting, a few small conical teeth at symphysis. Upper jaw with only a very shallow median indentation at pre-maxillary symphysis, a single series of fine teeth on either side of this. Lower edge of maxilla denticulated; two supra-maxillae, the 2nd (posterior) expanded ventrally and tapering posteriorly. Frontals with a pair of narrowly separated longitudinal ridges on each side, the inner pair continuing posteriorly to hind end of skull, converging slightly but not joining; a shorter longitudinal ridge on each side lateral to main ridges and lying above the temporal foramen.

Pseudobranch present, exposed, $\frac{1}{2}$ eye diameter. Gillrakers moderately slender, $1\frac{3}{4}$ times length of gill filaments, $\frac{1}{2}$ eye diameter.

Dorsal fin origin nearer to caudal base than to snout tip by $\frac{1}{2}$ eye diameter. Pectoral fin tips (broken). Pelvic fin base slightly nearer to pectoral base than to anal origin. The latter nearer to pectoral base than to caudal base by $1\frac{1}{3}$ eye diameters.

COLOUR: upper $\frac{1}{5}$ grey, remainder of flanks silver. Fins hyaline.

IDENTIFICATION. The slender body places this fish in *I. elongata*. Valenciennes felt that this species most closely corresponded to *Clupea sima* Linnaeus, although

he felt that the pelvic fins were a little more obvious than was suggested by Linnaeus' phrase "ventrales adeo parvae ut vix conspicuae". The type locality of *Clupea sima* is "Asia", which gives no clue and the name is perhaps best regarded as a *nomen dubium*.

77. *Pellona novacula* Valenciennes, 1847
= *Ilisha elongata* (Bennett, 1830)

Pellona novacula Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 319 (Rangoon ; 1 fish, 6 inches ; Regnault).

TYPE MATERIAL. MNHN. 3704, 1 fish, 131.7 mm. S.L., ex Rangoon, coll. Regnault (1829).

DESCRIPTION. *Holotype*, a fish of 131.7 mm. S.L., ex Rangoon, coll. Regnault, no scales, pectoral and pelvic fin tips slightly broken, otherwise in good condition, MNHN. 3704.

Br.St. 6, D iii 13, P i 14, V i 6, A iv 39, g.r. 10 + 24, scutes 25 + 10.

In percentages of standard length : body depth 24.2, head length 22.8 ; snout length 6.1, eye diameter 5.9, length of upper jaw 11.8, length of lower jaw 12.5 ; pectoral fin length 16.5, pelvic fin length 3.7, length of anal fin base 29.2 ; pre-dorsal distance 61.1, pre-pelvic distance 42.7, pre-anal distance 66.1.

Body compressed, belly keeled, body depth only a little greater than head length. Lower jaw projecting strongly, 6-8 small conical teeth at dentary symphysis. Upper jaw with a small V-shaped notch at pre-maxillary symphysis, rest of pre-maxillae with a single series of small teeth. No hypo-maxilla. Maxilla with denticulations (some with the appearance of teeth) along lower edge ; two supra-maxillae, the 2nd (posterior) expanded ventrally and tapering posteriorly (Figure 8b). Frontals with a pair of parallel longitudinal ridges on either side diverging posteriorly ; a very short median ridge on supra-occipital.

Pseudobranch present, exposed, just longer than $\frac{1}{2}$ eye diameter. Gillrakers moderately slender, twice as long as gill filaments, just over $\frac{1}{2}$ eye diameter. About 2-3 small gillrakers present on posterior face of 3rd epibranchial.

Dorsal fin origin equidistant between caudal base and gill opening. Pectoral tips broken, but probably reaching to pelvic base in life. Pelvic base nearer to pectoral base than to anal origin by $1\frac{1}{4}$ eye diameters. Anal origin nearer to pelvic base than to caudal base by $2\frac{1}{4}$ eye diameters, lying below 4th branched dorsal ray.

COLOUR : upper $\frac{1}{10}$ dark brown, remainder of flanks silver. Fins hyaline.

IDENTIFICATION. The slender body and posteriorly placed dorsal identify this fish with *Ilisha elongata*.

OPISTHOPTERUS Gill, 1861

Opisthopterus Gill, 1861, *Proc. Acad. nat. Sci. Philad.* : 38 (Type : *Pristigaster tartoor* Valenciennes = *Pristigaster tardoore* Cuvier).

Cuvier (1829) and Valenciennes (1847 : 326) combined a single Indian Ocean species with the one or more species of true *Pristigaster* from South America, mainly because all these fishes lack pelvic fins. Gill (1861) was the first to separate the

Indian Ocean fishes from the rest at generic level. Norman (1923) did not question this, but he combined the Indian Ocean *Opisthopecterus* with the New World species *O. dovii* (Günther), *O. effulgens* (Regan) and *O. macrops* (Günther). In spite of the isolation of these two groups of species there are only very minor differences between them. The teeth in the upper jaw are better developed in the New World species, while the Indo-Pacific species have a broader edentulous area at the pre-maxillary symphysis.

The latest review of the Indo-Pacific species of *Opisthopecterus* (Whitehead, *et alii*, 1966) recognized two species, the deeper-bodied *O. tardoore* (Cuvier) and the more slender *O. valenciennesi* Bleeker. The two species are further distinguished by differences in jaw shape and pectoral length.

78. *Pristigaster tardoore* Cuvier, 1829
= *Opisthopecterus tardoore* (Cuvier, 1829)

Pristigaster tardoore Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 321 (on the *Tartoore* of Russell, 1803, *Fishes of Coromandel* : 74, pl. 193, *ex* Vizagapatnam).

Pristogaster elongata Swainson, 1838, *Nat. Hist. Animals*, 1 : 278 (on Russell's *Tartoore*, pl. 193).

Pristogaster indicus Swainson, 1839, *Ibid*, 2 : 294 (on Russell's *Tartoore*, pl. 193).

Pristigaster tartoor : Valenciennes, 1847, *Hist. Nat. Poiss.*, 20 : 328 (Pondichéry, Malabar ; many fishes, to 8 inches, reported to 10 inches ; Leschenault, Dussumier).

SPECIMENS. MNHN. 1688, 1 fish, 139.1 mm. S.L., *ex* Pondicherry, coll. Leschenault (1818).

MNHN. 3698, 2 fishes, 154.2–177.0 mm. S.L., *ex* Pondicherry, coll. Dussumier (1830).

MNHN. 3701, 8 fishes, 64.0–69.0 mm. and 108.9–161.6 mm. S.L., *ex* Malabar, coll. Dussumier (no date).

MNHN. 3702, 2 fishes, 118.7–122.0 mm. S.L., *ex* Mahé Malabar, coll. Dussumier (1832).

All these specimens are *O. tardoore* ; *O. valenciennesi* is not represented amongst the Valenciennes material. Only the first of these specimens was available to Cuvier before publication of the 2nd edition of the *Règne Animal* (1829), and although he based the name *tardoore* on Russell's illustration, he may well have seen this early Leschenault specimen. It is here described as a possible neotype.

DESCRIPTION. *Putative neotype*, a fish of 139.1 mm. S.L., *ex* Pondicherry, coll. Leschenault, in fair condition but tips of caudal, dorsal and pectorals slightly damaged, scales now missing, MNHN. 1688.

Br.St. 6 (left 7), D iii 12, P i 12, V—, A iii 54 (12th ray missing), g.r. 10 + 28, scutes 30 (total).

In percentages of standard length : body depth 31.3, body width 6.3, head length 20.4 ; snout length 4.6, eye diameter 7.0, length of upper jaw 11.9, length of lower jaw 10.1 ; pectoral fin length 26.2, length of anal fin base 51.4 ; pre-dorsal distance 65.6, pre-anal distance 54.6.

Body highly compressed, its width 5.4 times in its depth, belly sharply keeled. Snout length a little over half eye diameter. Upper jaw with median edentulous

area not indented, a single series of fine teeth on either side. Maxilla reaching to just beyond vertical from eye centre, reaching beyond articulation of lower jaw ; expanded portion of maxilla 2.38 times as long as deep ; two supra-maxillae present, the 2nd (posterior) expanded ventrally ; maxilla projecting only slightly (1.5 mm.) beyond posterior tip of 2nd supra-maxilla (Figure 9a). Lower jaw prominent. Frontals with a pair of parallel longitudinal ridges on each side, the inner ones continuing to hind end of skull ; two shorter longitudinal striae above the temporal foramen.

Pseudobranch present, exposed, equal to $\frac{1}{2}$ eye diameter. Gillrakers moderately slender, $1\frac{3}{4}$ times gill filaments, $\frac{1}{2}$ eye diameter. Isthmus short, bearing scutes.

Dorsal fin origin above 16th branched anal ray. Pectoral fin with first ray flattened, reaching almost to anal origin ; pectoral base set high on body, almost on midline. Pelvic fins absent. Anal origin equidistant between snout tip and caudal base.

COLOUR : upper $\frac{1}{10}$ of body brown, remainder of flanks silvery. Fins hyaline.

IDENTIFICATION. The differences separating *O. tardoore* from *O. valenciennesi* detailed by Whitehead, *et alii* (1966), which were based on Bleeker's Indonesian material, are confirmed by the present specimen.

Note. Russell's illustration of *Tartoore* (see Plate 9a), which formed the basis of Cuvier's species *Pristigaster tardoore*, shows a fish of 157 mm. S.L. It clearly represents a species of *Opisthopterus*, but details of the jaws are poorly shown and cannot be used to identify it. However, the body depth ($3\frac{1}{3}$ times in S.L.) and the long pectoral fins (to anal origin) identify the fish as *O. tardoore* (cf. $3\frac{1}{2}$ –4 times, and well short of anal origin in *O. valenciennesi*).

As shown earlier (p. 115), Swainson (1838) also named Russell's figure of *Tartoore*, giving it the name *Pristogaster elongata*. A year later Swainson (1839) changed this name to *P. indicus*. It is unlikely that he made this change because of possible homonymy with *Alosa elongata* Bennett (= *Ilisha elongata*), anticipating a fusion of his genera *Platygaster* and *Pristogaster* ; for he then proposed a second *indicus* to replace his earlier *Platygaster verticalis*, the latter name certainly not being in any danger of homonymy.

Authors have unanimously overlooked Swainson's earlier name *elongata*. Norman (1923) also overlooked Cuvier's name *tardoore* but used Swainson's second name, *indicus*. The name *tartoor* used by Valenciennes is almost certainly a corrected spelling of *Tartoore* (cf. *tardoore* of Cuvier), although he does not refer to Cuvier in the text.

Valenciennes (1847 : 333) identified the illustration given by Gray (1835 : pl. 92, fig. 1) of *Apterygia ramcarata* as this species, suggesting that the absence of a dorsal fin was due to mutilation. The absence of a dorsal fin is now recognized as a normal feature of the monotypic *Raconda russeliana* Gray. Valenciennes misquoted the caption of Gray's plate as *Apterygia hamiltoni* ; fig. 3 of this plate is labelled *Thrissa hamiltonii* and illustrates an engraulid.

Family **ENGRAULIDAE**
ENGRAULIS Cuvier, 1817

[*Engraulis* Bosc, 1816, *Nouv. Dict. d'Hist. Nat. (Nouv. ed.)*, **1** : 493 (on Cuvier's MS ; no type) ; *Idem*, 1817, *ibid.*, **10** : 256 (" M. Cuvier donne ce nom au sousgenre des Anchois, dans le genre *Clupea* ").]

Engraulis Cuvier, 1817, *Règne Animal*, 1st ed., **2** : 174 (Type: *Clupea encrasicolus* Linnaeus, designated by Fleming, 1822, *Phil. Zool.*, **2** : 385).

Encrasicholus Fleming, 1828, *Hist. Brit. Anim.*: 183 (Type : *Encrasicholus encrasicolus* L.) (corrigenda states :—for *Encrasicholus* read *Engraulis*).

The late 18th and early 19th centuries saw the beginnings of a veritable spate of popular dictionaries and general works on natural history. In a number of cases such works now contain *nomina oblita*, hitherto overlooked genotype designations, and prior uses of names awaiting publication by a better known author. Bosc (1816, *et seq.*), for example, appears to have had access to Cuvier's manuscript of the *Règne Animal* (1st ed.) before the latter was published,* but the only clupeoid name that may be pre-dated is *Engraulis* (listed under *Anchois*) ; the Cuvier names *Alosa*, *Thryssa*, and *Chatoessus* are given only in the vernacular. Whitely (1934, 1935, 1936 and 1939) gave a useful list of many of these early popular works, with particular reference to selections of the types of genera.

Whitley (1935) cited Bosc as selector of *Clupea encrasicolus* as type species of *Engraulis*, but Bosc makes no mention of a species ; "*encrasicholus*" is merely listed (by Desmarest in Vol. 10 of the same work) with the citation " Nom de l'Anchois, selon Rondelet [DESM] ". The first selector appears to have been Fleming (1828 : 385), who placed a single species in parenthesis after each one of the seven subgenera of *Clupea* that he recognized (except in the case of *Pristigaster* Cuvier, for which no species is given).

The name *Engraulis* has for so long been associated with Cuvier's name that its possible accidental pre-dating by Bosc should be overlooked, particularly since both Bosc and Desmarest (who wrote the entry under *Engraulis*) specify that this was Cuvier's subgenus. A ruling on this will be sought from the International Commission.

Fleming (1828) proposed the generic name *Encrasicholus*, but withdrew it immediately in favour of *Engraulis* (see synonymy above). The name *Encrasicholus* Commerson will be dealt with under *Stolephorus* (p. 136).

Ten of the 27 clupeoids recorded by Lacepède (1803) are anchovies (Table 1), placed in three genera, *Stolephorus* (2), *Clupea* (7) and *Mystus* (i.e. *Coilia*) (1). Cuvier (1817 + 1829) listed 15 engraulids, placing 11 in *Engraulis* and 4 in *Thryssa*. Valenciennes (1848) returned *Thryssa* to the compendium genus *Engraulis* (23 species), but separated out *Coilia* (6 species). Günther (1868) also retained *Engraulis* as a compendium genus (37 species), although he recognized 6 subgenera, and he again kept species of *Coilia* generically distinct. Like *Clupea*, *Engraulis* has been gradually depleted of species in the present century, until only four or five very closely related species remain (Whitehead, 1964b).

* This probably holds true even if the earlier dating of the *Règne Animal* is accepted, i.e. before Dec. 7th, 1816, cf. Sept. 14th, 1816 for the Bosc reference (*vide* Mathews 1911). See p.8 for further discussion.

79. *Engraulis argyrophanus* Valenciennes, 1848
 = *Engraulis encrasicolus* (Linnaeus, 1758)

Clupea encrasicolus Linnaeus, 1758, *Syst. Nat.* 10th ed.: 318 (European seas).

Engraulis argyrophanus Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 49 ("ocean Atlantique équatorial" between Europe and Batavia ; many fishes, to 4 inches ; Kuhl & van Hasselt).

TYPE MATERIAL. MNHN. A.7614, 5 fishes, 66.0–88.7 mm. S.L., *ex* equatorial Atlantic, gift from Leiden Museum.

RMNH. 3331, 2 fishes, 86.9–94.9 mm. S.L., formerly and erroneously labelled "Java", see below.

The Paris specimen labelled with a paper tag is here selected as lectotype.

DESCRIPTION. *Lectotype*, a fish of 88.5 mm. S.L., *ex* tropical Atlantic (presumed off western coast of Africa), coll. Kuhl & van Hasselt, in moderate condition, right flank partly scaled, MNHN. A.7614.

(measurements of two Paris lectotypes, 88.7 and 88.5 mm. S.L., placed in parenthesis)

Br.St. 13 (14, 13), D iii 13 (12, 13), P i 14 (14, 14), A iii 15 (14, 15), g.r. 30 (29, 30), no scutes.

In percentages of standard length : body depth 17.5 (17.6, 17.2), head length 25.4 (25.6, 25.0) ; snout length 4.7 (4.4, 4.3), eye diameter 5.4 (5.4, 5.2), length of upper jaw 19.1 (18.9, 18.6), length of lower jaw 16.7 (17.5, 16.4) ; pectoral fin length 13.5 (13.4, 13.1), pelvic fin length 9.5 (10.0, 9.4), length of anal fin base 13.2 (13.5, 13.3) ; pre-dorsal distance 52.3 (51.3, 51.7), pre-pelvic distance 47.8 (49.2, 45.6), pre-anal distance 72.5 (70.5, 67.9).

Body little compressed, subcylindrical, its width just less than twice in depth, belly rounded, body depth almost $1\frac{1}{2}$ times in head length. Snout a little shorter

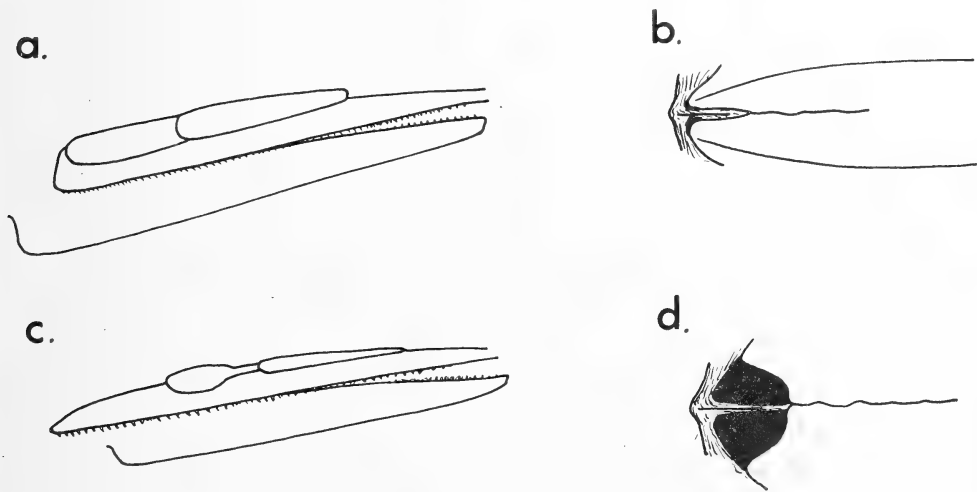


FIG. 10. Upper jaw and dorsal view of posterior frontal fontanelles (black), in *Engraulis* (a, b) and *Anchoa* (c, d). a, b. *Engraulis argyrophanus* lectotype (= *E. encrasicolus*), 88.5 mm. S.L. (MNHN. A. 7614). c, d. *Engraulis mitchilli* lectotype (= *Anchoa mitchilli*), 60.2 mm. S.L. (MNHN. A. 7930).

than eye diameter. Maxilla not quite reaching to articulation of lower jaw ; two supra-maxillae (Figure 10a), the 1st (anterior) about 5-6 times as long as deep, overlapping 2nd (posterior) supra-maxilla ; the latter almost reaching to posterior tip of maxilla ; pre-maxilla, maxilla and dentary finely toothed. Frontal tips almost joined in the midline posteriorly, posterior frontal fontanelles completely occluded (Figure 10b).

Pseudobranch present, exposed and long, about $1\frac{1}{2}$ times eye diameter, with 4 filaments lying on the inner face of the operculum. Gillrakers slender, a little more than twice the length of the corresponding gill filaments, $\frac{7}{8}$ eye diameter ; 9-10 stumpy gillrakers on posterior face of 3rd epibranchial. Isthmus silver, long, reaching to hind margin of branchiostegal membrane ; a slight ventral bulge at anterior end of muscular portion of isthmus.

Dorsal fin with minute 1st unbranched ray ; dorsal origin equidistant between nostril and caudal base. Pectoral fins failing to reach pelvic base by $1\frac{1}{2}$ eye diameters. Pelvic fin base in advance of dorsal origin by $\frac{3}{4}$ eye diameter, nearer to pectoral base than to anal origin by $1\frac{3}{4}$ eye diameters ; innermost rays of pelvic fin joined across body by membrane along half their length. Anal origin behind vertical from last dorsal ray by $1\frac{2}{3}$ eye diameters ; nearer to caudal base than to pelvic base by $\frac{3}{4}$ eye diameter.

Alar scales present.

COLOUR : upper $\frac{1}{5}$ brown ; a black longitudinal stripe, $\frac{2}{3}$ eye diameter, along flank, the flank below this being silver-gold merging to silver.

IDENTIFICATION. The short maxilla, absence of scutes, occluded posterior frontal fontanelles and long pseudobranch, place these specimens in *Engraulis*. The identification of the species involved depends on the provenance of the specimens. There are as yet few satisfactory diagnoses of the tropical forms of *Engraulis*, and the latter appear at present to merge with the better known species of temperate seas, at least in the Eastern Atlantic and Indo-Pacific areas (Whitehead, 1964b). If, as seems likely, the Kuhl & van Hasselt specimens came from the Eastern Atlantic, they are best regarded as *E. encrasicolus*. The tropical Indo-Pacific forms of *Engraulis* may eventually be found to connect *E. japonicus* Temminck & Schlegel with *E. australis* (White) and *E. capensis* Gilchrist (Whitehead, *et alii*, 1966), and these in turn may be considered only subspecifically distinct from the Atlantic *E. encrasicolus*.

Note. Within the Engraulidae, *Engraulis* was formerly considered " the only [genus] confined to temperate seas " (Jordan & Seale, 1926), and it has been cited as an example of anti-tropical distribution (Hubbs, 1952). Cadenat (1950) suspected that *Engraulis* was present in the Gulf of Guinea, but Rossignol & Blanche (1961) described specimens from there as *Anchoviella guineensis*. I have since shown that these are true *Engraulis* (Whitehead, 1964b). It is, therefore, quite possible that the Kuhl & van Hasselt specimens were caught off the western coast of Africa (they sailed via Madeira). Dr. Boesman (*in litt.*) has pointed out that van Hasselt, in a letter dated October 22nd 1820 (published in Konst- en Letter-Bode, 1821, part 1 : 180-181), mentions legions of "*Stylophorus commersonii*" from between the tropics, and this may well refer to the present species.

Jordan & Seale (1926) identified *Engraulis argyrophanus* with *Anchoviella eurystole* (Swain & Meek), Jordan having examined the type in Paris some 40 years previously (Jordan, 1887). Hildebrand (1943, 1964) disagreed, and placed it with *Anchoviella perfasciata* (Poey). In the event, Jordan & Seale were nearer the truth, since *A. eurystole* is a member of *Engraulis* (Whitehead, 1964b), whereas *A. perfasciata* is clearly *Anchoviella*. Since *Engraulis encrasicolus*, the only anchovy species known in the Eastern Atlantic, was not at that time recorded from the tropical areas, these American writers assumed that *Engraulis argyrophanus* must have been a stray from the Western Atlantic. Thus certain American writers have used the name *argyrophanus* for specimens of anchovy with a short maxilla caught between New Jersey and Cape Cod (Hildebrand, 1964 : 210, 215). The earliest record of *Engraulis* in the Western Atlantic is by Fabricius (1780), based on remains from seal stomachs off western Greenland, but there can be no certainty about the identification, the American engraulid fauna being then little known.

80. *Engraulis meletta* Cuvier, 1829
= *Engraulis encrasicolus* (Linnaeus, 1758)

Engraulis meletta Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 323 (Mediterranean ; on Duhamel, Sect. VI, pl. 3, fig. 5).

IDENTIFICATION. Cuvier based this species solely on the *Melet* described by Duhamel (1777 : 157-158 and pl. 3, fig. 5). The figure given by Duhamel (shown here, Plate 9b) is quite recognizable as the European anchovy, and its provenance in the Mediterranean makes no other interpretation possible.

ANCHOA Jordan & Evermann, 1927

Anchoa Jordan & Evermann, 1927, *Proc. Calif. Acad. Sci.*, 4 (16) : 501 (Type : *Engraulis compressus* Girard).

This is the largest anchovy genus. Hildebrand (1943) included 38 species, separated by a long and necessarily awkward key, since there is little to distinguish many of the species except minor meristic differences.

Anchoa lyolepis (Evermann & Marsh), *A. argentivittata* (Regan) and *A. duodecim* (Cope) differ from the remainder in having longer pseudobranchs, a more posterior anal fin origin and smaller posterior frontal fontanelles, characters which link them with the species of *Engraulis*. However, all three have the long maxilla of *Anchoa*. There seems to be some justification for splitting off these three species, perhaps as a subgenus, but the remaining species are externally very similar to each other.

81. *Engraulis mitchilli* Valenciennes, 1848
= *Anchoa mitchilli* (Valenciennes, 1848)

Engraulis mitchilli Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 50 (New York, also Lac Pontchartrain, near New Orleans ; some specimens, no size ; Milbert and Leconte, also LeSueur).

TYPE MATERIAL. MNHN. 3722, 6 fishes, 64.5-72.2 mm. S.L., ex New York, coll. Milbert (1822).

MNHN. A.7930, 2 fishes, 60.2-62.0 mm. S.L., ex New York, coll. Leconte (1827).

The six Milbert fishes are in poor condition. The smaller of the two Leconte fishes is well preserved and is selected as lectotype (it bears a paper tag).

DESCRIPTION. *Lectotype*, a fish of 60.2 mm. S.L., ex New York, coll. Leconte, in good condition, MNHN. 7930.

Br.St. 9, D iii 12, P i 11, V i 6, A iii 24, g.r. 21.

In percentages of standard length : body depth 24.4, head length 23.7 ; snout length 5.0, eye diameter 7.5, length of upper jaw 22.7, length of lower jaw 17.4 ; pectoral fin length 12.7, pelvic fin length 8.3, length of anal fin base 29.6 ; pre-dorsal distance 59.0, pre-pelvic distance 46.6, pre-anal distance 61.3.

Body moderately compressed, its depth about equal to head length. Snout length a little less than eye diameter. A few small teeth in lower jaw. Upper jaw toothed along entire length, teeth moderate, not closely spaced but even. Maxilla tip reaching beyond articulation of lower jaw to edge of gill cover ; two supra-maxillae present (Figure 10c), the 1st (anterior) slender, the 2nd (posterior) slightly expanded posteriorly, both above and below its axis ; maxilla projecting posteriorly well beyond 2nd supra-maxilla. A pair of well-formed posterior frontal fontanelles, about as long as wide, lateral boundaries forming sigmoid curve (Figure 10d).

Pseudobranch present, small, covered by skin, about $\frac{1}{2}$ eye diameter. Gillrakers slender, $2\frac{1}{2}$ times length of corresponding gill filaments, $\frac{2}{3}$ eye diameter.

Dorsal fin origin nearer to caudal base than to posterior rim of eye by 1 eye diameter. Pectoral fins (tip broken) probably failing to reach pelvic base by about 1 eye diameter ; axillary scale present, about $\frac{2}{3}$ length of fin. Pelvic fin base 2 eye diameters before vertical from dorsal origin, nearer to pectoral base than to anal origin by 1 eye diameter ; axillary scale present, almost length of fin. Anal fin origin below 3rd unbranched dorsal ray, nearer to pectoral than to caudal base by $\frac{3}{4}$ eye diameter.

COLOUR : body brown, with faint midlateral silvery stripe ; caudal peduncle with a single row and a double row of small melanophores respectively along the bottom and the top of the caudal peduncle. A short diagonal row of dark brown spots across upper corner of caudal peduncle and a longer but similar row below it. Fins hyaline.

IDENTIFICATION. The lectotype agrees well with the diagnosis of *Anchoa mitchilli mitchilli* given by Hildebrand (1943, 1964). Hildebrand (1943) described a southern subspecies with a slightly deeper and more compressed body and rather fewer gillrakers. Valenciennes' Lac Ponchartrain specimens sent to him by Lesueur (see synonymy below) are here placed in Hildebrand's subspecies.

Note. There are many species of *Anchoa* and *Anchoviella* along the Western Atlantic coast and these bear a superficial resemblance to certain Indo-Pacific anchovies (e.g. species of *Stolephorus*). Early authors not only combined anchovies from these two quite separate regions, but also confused true anchovies with silver-sides (Fam. Atherinidae). The result was that Marcgrav's name *Piquitinga* and Browne's *Menidia*, and latinized derivatives such as *brownii* and *menidia*, as well as Linnaeus' name *hepsetus*, became almost meaningless. Valenciennes attempted to

resolve the question of the identity of *Atherina menidia*, *A. brownii*, *A. australis* and *Esox hepsetus*, and although removing the atherinid elements, ended up with an *Engraulis brownii* composed of Western Atlantic *Anchoa* (and possibly *Anchoviella* and *Engraulis*) plus Indian Ocean *Stolephorus* and a suggestion that the Australian *Engraulis* should also be considered.

Thus Valenciennes' discussion of *Atherina menidia* and Mitchill's *Clupea vittata* and *C. caerulea* as possible synonyms (at least in part) of *Engraulis mitchilli*, is based on misconceptions. Hildebrand (1943) correctly equated *Piquitinga* and *Menidia* with *Esox hepsetus* Linnaeus (i.e. *Anchoa hepsetus*) and placed Mitchill's *vittatus* in the same synonymy, although the latter step is debatable; Mitchill's clupeoid descriptions are very poor (Whitehead, 1965d) and the Western Atlantic species of *Engraulis* is equally possible (i.e. *Anchoviella eurystole* of authors).

82. *Engraulis louisiana* Valenciennes, 1848
= *nomen nudum*

Engraulis louisiana Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 51 (on MS description of LeSueur, ex Lac Ponchartrain near New Orleans) (name in synonymy).

Anchoa mitchilli diaphana Hildebrand, 1943, *Bull. Bingh. oceanogr. Coll.*, **8** (2) : 91 (*diaphana* to replace *louisiana*, the latter a *nomen nudum*; South Carolina to Yucatan).

TYPE MATERIAL. MNHN. 3723, 2 fishes, 36.5–36.6 mm. S.L., ex Lac Ponchartrain, Louisiana (U.S.A.), coll. LeSueur (1830).

Note. Valenciennes (1848 : 51) merely mentioned this name as a synonym of his own *E. mitchilli*, stating that "M. Lesueur a eu aussi cette espèce qu'il a décrite et figurée sous le nom d'*Engraulis Louisiana*, d'après des individus qu'il avait observés dans le lac Ponchartrain, à la Nouvelle-Orléans." The name *louisiana* seems to have been a manuscript name used by LeSueur when sending material to Valenciennes. The name was thus first published as a synonym, and it has not been used since as a senior synonym; Hildebrand (1943) was correct in proposing the name *diaphana* for his southern subspecies of *Anchoa mitchilli*. The present specimens are, therefore, not types and did not figure in Hildebrand's description of *A. m. diaphana*.

83. *Engraulis spinifer* Valenciennes, 1848
= *Anchoa spinifer* (Valenciennes, 1848)

Engraulis spinifer Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 39 (Cayennes; some fishes, 6 inches; Poiteau—also some sent by Leconte).

TYPE MATERIAL. MNHN. 3754, 6 fishes, 76.9–100.0 and 131.4 mm. S.L., ex Cayenne, coll. Poiteau.

From these, the largest specimen (bearing paper tag) has been chosen as lectotype.

DESCRIPTION. Lectotype, a fish of 131.4 mm. S.L., ex Cayenne (French Guiana), coll. Poiteau, in fair condition, scales gone, upper caudal tip broken, MNHN. 3754.

Br.St. 13, D iii 13, P i 12 (both), V i 6, A iii 34 (in paralectotypes 33 (f.1), 34 (2), 35 (2), 36 (1), all with iii unbranched rays), g.r. 12 + 16, scutes absent.

In percentages of standard length : body depth 25.3, head length 25.3 ; snout length 3.9, eye diameter 4.6, length of upper jaw 24.5, length of lower jaw 19.3 ; pectoral fin length 18.7, pelvic fin length 7.9, length of anal fin base 35.1 ; pre-dorsal distance 48.7, pre-pelvic distance 41.5, pre-anal distance 56.5.

Body compressed, its depth equal to head length. Snout length a little less than eye diameter. Jaws with a single series of fine, close-set teeth of even length. Maxilla reaching almost to gill opening and a little beyond articulation of lower jaw ; 1st (anterior) supra-maxilla not found (absent in other specimens) ; 2nd (posterior) supra-maxilla long and slender, failing to reach posterior tip of maxilla, the latter a little pointed and toothed along ventral edge as far as tip (Figure 11). Operculum and sub-operculum narrow and inclined at an angle of 45° ; sub-operculum almost square, with a triangular projection from the upper half of the posterior margin ; opercular series failing to cover gill opening completely. A semicircular fleshy process with small canals behind gill opening.

Pseudobranch present, distal half of filaments exposed, remainder covered, its length $\frac{2}{3}$ of eye diameter. Gillrakers moderately stout, $1\frac{1}{3}$ times as long as corresponding gill filaments, a little greater than $\frac{1}{2}$ eye diameter ; gillraker serrae becoming stronger and more crowded distally ; 6 very short rakers on posterior part of 3rd epibranchial.

Dorsal fin origin nearer to snout tip than to caudal base by 1 eye diameter ; height of fin 21.9 per cent. of S.L. Pectoral fin reaching 1 eye diameter beyond pelvic fin base, and $\frac{1}{2}$ eye diameter in front of vertical from dorsal origin ; 1st ray flattened, with a fleshy appendage above, $\frac{1}{4}$ length of fin itself. Pelvic fin base

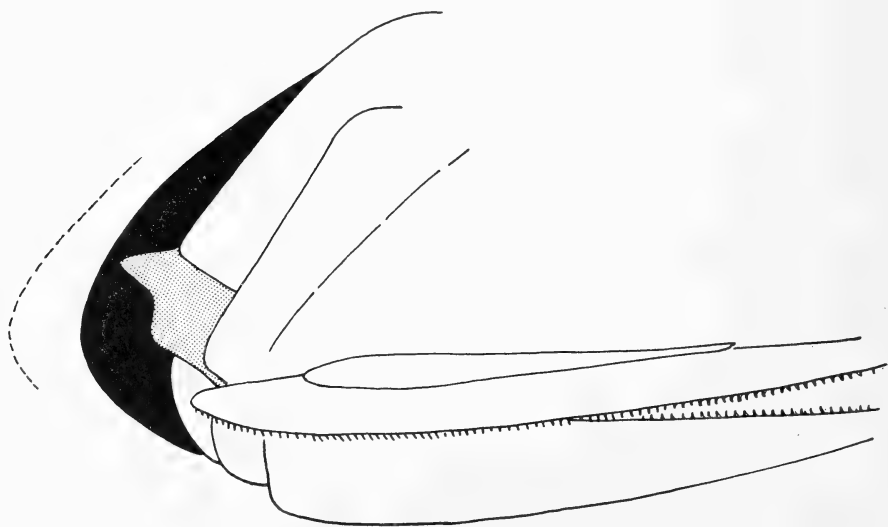


FIG. 11. Upper jaw and opercular bones (right side) in *Engraulis spinifer* lectotype (= *Anchoa spinifer*), 131.4 mm. S.L. (MNHN. 3754). Sub-operculum stippled, gill opening black.

equidistant between pectoral base and anal fin origin ; a fleshy axillary appendage, $\frac{2}{3}$ length of fin ; innermost rays joined across body by membrane $\frac{2}{3}$ along their length. Anal fin origin below 9th branched dorsal ray, nearer to caudal base than to posterior rim of eye by $\frac{3}{4}$ eye diameter.

COLOUR : upper $\frac{1}{3}$ brown, remainder of flanks silver ; caudal with brown posterior fringe, remainder of fins hyaline.

IDENTIFICATION. The lectotype agrees well with the description given by Hildebrand (1964 : 167), except that the upper jaw is slightly longer and the lower jaw slightly shorter. Jordan & Seale (1926) used the name *spinifera*, noting, as did Valenciennes, the spine-like triangular process on the posterior margin of the sub-operculum.

Note. The following specimen is in the museum in Leiden : RMNH. 3356, 1 fish, 101.0 mm. S.L., ex Brazil, coll. Delalande (labelled *Engraulis dentatus*).

This fish is *Anchoa spinifer*, but it is not one of the syntypes of that species, since Valenciennes did not record Brazilian material.

84. *Engraulis lemniscatus* Cuvier, 1829
= *Anchoa tricolor* (Agassiz, 1829)

Engraulis lemniscatus Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 323 (on *Piquitinga* Marcgrav or *Engraulis piquitinga* Spix) (*nomen oblitum*).

Engraulis tricolor Agassiz, 1829, in Spix & Agassiz, *Pisc. Brazil.* : 51 (Bahia and Para).

Engraulis piquitinga Spix, 1829, in Spix & Agassiz, *Pisc. Brazil.* : 51, pl. 23, fig. 1.

IDENTIFICATION. Linnaeus (1758 : 314) based his *Esox hepsetus* on Marcgrav's *Piquitinga* and Browne's *Menidia*. Hildebrand (1964) identified this Linnaean fish with one of the commonest of all western Atlantic anchovies, for which the name "*brownii*" had been used by earlier authors. Spix (1829 : 51) described and figured a Brazilian species, *Engraulis piquitinga*, stating "non *Piquitinga* Marcgr., qui nullo modo ad genus *Engraulis* referri potest." As in the case of *Engraulis grossidens* (see p. 135), the Spix name is given as a synonym, the species being headed *Engraulis tricolor* Agassiz. Hildebrand (1943) separated *Anchoa tricolor* from *Anchoa hepsetus*, the first containing Spix's *piquitinga* and the second, Marcgrav's.

The Marcgrav *piquitinga* element in Cuvier's *Engraulis lemniscatus* should not be given much weight. The figure (shown here, Plate 10a) and description by Marcgrav (1648 : 159) are not sufficient to identify one out of about a dozen small species of anchovy in Brazilian waters. Cuvier was, however, well aware of Spix's figure of *Engraulis piquitinga*, citing it even though it was not published until shortly after the 2nd edition of the *Règne Animal* appeared. Since Cuvier did not also cite the name *Engraulis tricolor*, it must be presumed that he did not see the final text as amended by Agassiz.

Cuvier's *Engraulis lemniscatus* must, therefore, be taken as based primarily on the Spix figure, and thus to pre-date both the Spix and Agassiz names. It is not a *nomen nudum*, since it was based, in part at least, on a previous description and figure. But as a senior synonym, it becomes a *nomen oblitum*, having been unused even by

Valenciennes and Günther, as well as by subsequent authors (including Hildebrand, 1964).

CETENGRAULIS Günther, 1868

Cetengraulis Günther, 1868, *Cat. Fish. Brit. Mus.*, 7 : 383 (Type : *Engraulis edentulus* Cuvier, designated by Jordan & Evermann, 1896, *Bull. U.S. nat. Mus.*, 46 (1) : 450).

Characteristic of this genus are the broad branchiostegal membranes, the longest branchiostegal rays being about $\frac{1}{2}$ head length. As in *Engraulis*, the frontal tips meet in the midline posteriorly and the posterior frontal fontanelles are occluded in adults. Hildebrand (1943, 1964) recognized three species, but the third, *Engraulis juruensis* Boulenger (known only from the holotype), lacks the broad branchiostegal membranes and is most closely related to the New World group that includes *Engraulis ringens* Jenyns, *E. mordax* Girard and *E. anchoita* Hubbs & Marini. Hildebrand (1943) separated the Atlantic *Cetengraulis edentulus* from the Pacific *C. mysticetus* on head length and shape, body depth and anal finray count and in these the two species appear to be quite distinct:

85. *Engraulis edentulus* Cuvier, 1829 = *Cetengraulis edentulus* (Cuvier, 1829)

Engraulis edentulus Cuvier, 1829, *Règne Animal*, 2nd ed., 2 : 323 (Jamaica, on Sloane, 1725, *Voy. to Jamaica*, 2 : pl. 250, fig. 2 (1)); Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 51 (Rio de Janeiro, also Cuba, Guadeloupe and Montevideo ; some fishes, to 6 inches ; Quoy & Gaimard, Lesson & Garnaud, Ménétrier & Gay, also Desmarests, Ricord and d'Orbigny).

TYPE MATERIAL. *MNHN*. 899, 1 fish, 121.0 mm. S.L., ex Rio de Janeiro, coll. Gay (1837).

MNHN. 3724, 1 fish, 116.9 mm. S.L., ex Cuba, coll. Desmarests (1826).

MNHN. 8175, 1 fish, 93.8 mm. S.L., ex Guadeloupe, coll. Ricord (dry, left side only).

MNHN. 3725, 1 fish, 88.2 mm. S.L., ex Montevideo, coll. d'Orbigny (1827).

The Desmarests and d'Orbigny specimens are the only ones that might have been examined by Cuvier. But since he made no mention of specimens, the largest and best of the four extant fishes is here chosen as putative neotype.

DESCRIPTION. *Putative neotype*, a fish 121.0 mm. S.L., ex Rio de Janeiro, coll. Gay, scales present, slight damage to belly behind pelvic base but otherwise in good condition, *MNHN*. 899.

Br.St. 8, D iii 13, P i 14, V i 6, A iii 23, g.r. 51, scales 35.

In percentages of standard length : body depth 32.5, head length 38.9 ; snout length 4.9, eye diameter 7.7, length of upper jaw 23.5, length of lower jaw 19.3 ; pectoral fin length 15.3, pelvic fin length 7.9, length of anal base 23.0 ; pre-dorsal distance 57.2, pre-pelvic distance 47.5, pre-anal distance 67.3.

Body fairly strongly compressed, its width $2\frac{3}{4}$ in its depth. Snout prominent, just over $\frac{1}{2}$ eye diameter. Anterior tip of lower jaw below anterior border of eye. No teeth in jaws, but fine denticulations on lower edge of expanded (posterior) part

of maxilla. Maxilla slightly pointed posteriorly, its tip not quite reaching to articulation of lower jaw ; a single (posterior) supra-maxilla present, tapering gradually to form slender anterior shaft (Figure 12b). Frontals with a lateral ridge on each side of the head and a low median ridge ; posterior tips of frontals almost joined in the midline posteriorly.

Pseudobranch present, exposed, its length equal to 1 eye diameter. Gillrakers fine and numerous, twice length of gill filaments and $\frac{7}{8}$ eye diameter ; each raker with a double row of fine, close-set serrae along inner edge ; gillrakers absent on posterior face of 3rd epibranchial. Branchiostegal membrane broadly united across isthmus ; dentary symphysis to hind margin of membrane almost twice eye diameter ; 1st branchiostegal ray 10.1 per cent. of S.L., $3\frac{1}{2}$ times in head.

Dorsal fin origin equidistant between caudal base and eye centre ; a low scaly sheath present. Pectoral fins reaching to just beyond pelvic base ; axillary scale present, almost length of fin ; bases of rays covered by scaly sheath. Pelvic fin base nearer to pectoral base than to anal origin by almost 1 eye diameter ; axillary scale present, equal to length of fin. Anal fin origin below 9th branched dorsal ray, equidistant between pectoral and caudal bases ; a low scaly sheath present.

Scales with reticulated pattern on exposed portion ; alar scales present.

COLOUR : upper $\frac{1}{3}$ brown, remainder of flanks golden. Fins hyaline.

Note. Sloane (1725 : 282) named his specimens "Harengus minor", stating that "I could not find any difference between this Sprat and that of England, but perhaps it may be the young one of some of the former kind of Herrings" (i.e. the "Pounder", *Elops saurus*). The Sloane drawing (see Plate 11a) is unmistakably *Cetengraulis* ; although details are rather sketchy, the general outline and positioning of jaws, eye, fins, etc. are remarkably accurate. The large gape in *Cetengraulis* is quite unlike that of the European sprat (*Sprattus sprattus*), but Sloane may have been referring here to the European anchovy. If Cuvier (1829 : 323) based his species solely on the Sloane figure and description, it is curious that he should have drawn particular attention to the toothless jaws, a feature not mentioned by Sloane and not apparent in Sloane's figure. Cuvier may thus have examined specimens.

Hildebrand (1943, 1964) included *Stolephorus surinamensis* Bleeker in the synonymy of *Cetengraulis edentulus*. This Bleeker species is in fact a member of the *pallida-potiana* group of *Anchovia* and has normal branchiostegal membranes (types in Leiden examined).

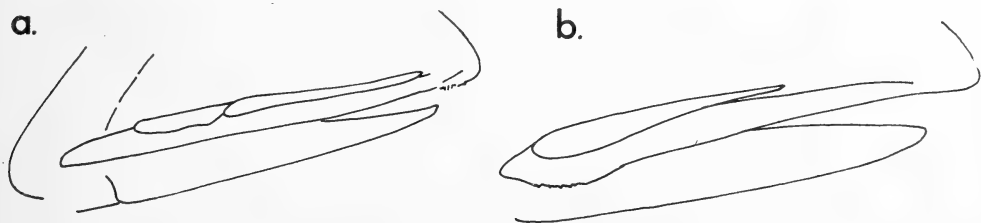


FIG. 12. Upper jaw (right side) showing shape of supra-maxillae. a. *Engraulis dentex* lectotype (= *Lycengraulis grossidens*), 162.5 mm. S.L. (MNHN. 3720). b. *Engraulis edentulus* lectotype (= *Cetengraulis edentulus*), 121.0 mm. S.L. (MNHN. 899).

LYCENGRAULIS Günther, 1868

Lycengraulis Günther, 1868, *Cat. Fish. Brit. Mus.*, **7** : 399 (Type : *Engraulis grossidens* Agassiz, designated by Jordan & Evermann, 1896, *Bull. U.S. nat. Mus.*, **47** (1) : 451).

The latest review of this New World genus was that of Hildebrand (1943) and his diagnoses are followed here.

86. *Engraulis dentex* Valenciennes, 1848
= *Lycengraulis grossidens* (Agassiz, 1829)

Engraulis grossidens Agassiz, 1829, in Spix & Agassiz, *Pisc. Brazil.*: 50 (Rio de Janeiro ; name and brief description preceding *E. janeiro* Spix).

Engraulis janeiro Spix, 1829, in Spix & Agassiz, *Pisc. Brazil.*: 50, pl. 24, fig. 1 (Rio de Janeiro ; name as synonym).

Engraulis dentex Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 28 (Rio de Janeiro ; some specimens, 7–8 inches ; Delalande, Gay & Ménétrier).

TYPE MATERIAL. *MNHN*. 3720, 1 fish, 162.5 mm. S.L., *ex* Rio de Janeiro, coll. Gay (1833).

MNHN. 1102, 2 fishes, 139.5–160.0 mm. S.L., *ex* Rio de Janeiro, coll. Delalande (1819).

The first of these specimens is chosen as lectotype of *Engraulis dentex*. The Leiden specimen of *Anchoa spinifer* (see p. 131), which was labelled *Engraulis dentatus*, may have been a misidentified syntype of *E. dentex*.

DESCRIPTION. *Lectotype*, a fish of 162.5 mm. S.L., *ex* Rio de Janeiro, coll. Gay, in good condition, except some anterior scales missing, *MNHN*. 3720.

Br.St. 13, D iii 13, P i 14 (both sides), V i 7 (both sides), A iii 22, g.r. 13 + 18.

In percentages of standard length : body depth 24.7, head length 24.0 ; snout length 4.0, eye diameter 5.5, upper jaw length 21.4, lower jaw length 17.7 ; pectoral fin length 17.9, pelvic fin length 9.0, anal fin base 23.5 ; pre-dorsal distance 59.0, pre-pelvic distance 43.5, pre-anal distance 62.5.

Body moderately compressed, its width $2\frac{3}{4}$ times in its depth, belly rounded. Snout a little shorter than eye diameter, projecting beyond lower jaw. Teeth in jaws fairly widely spaced, those in the upper jaw becoming larger posteriorly, tending to point forwards, those in the lower jaw being larger and of even lengths. Maxilla reaching to just beyond articulation of lower jaw but not to hind margin of preoperculum ; two supra-maxillae present, the (1st anterior) thin, plate-like, lying on top of maxilla, the 2nd (posterior) a little expanded ventrally, not reaching to posterior tip of maxilla (Figure 12a). Small triangular posterior frontal fontanelles present.

Pseudobranch present, covered by membrane, its length $\frac{3}{8}$ of eye diameter. Gillrakers short (first two on upper arch mere stumps), longest raker $\frac{3}{4}$ of gill filament length, $\frac{1}{3}$ eye diameter ; about 6 short gillrakers present on posterior face of 3rd epibranchial.

Dorsal fin origin nearer to caudal base than to posterior rim of eye by 1 eye diameter. Pectoral fin failing to reach pelvic base by $\frac{1}{2}$ eye diameter ; axillary scale present, $\frac{2}{3}$ length of fin ; bases of pectoral rays covered by sheath of scales. Pelvic

fin base nearer to pectoral base than to anal origin by $\frac{1}{2}$ eye diameter ; fleshy axillary appendage present, $\frac{4}{5}$ length of fin ; bases of rays surrounded by scaly sheath ; last rays on each side joined by membrane for $\frac{3}{4}$ of their length. Anal fin origin equidistant between caudal and pectoral bases, below vertical from 6th branched dorsal ray.

Scales with 8 or more vertical striae on exposed portion, the upper and lower halves of the striae curved and forming at the horizontal axis of the scale an obtuse angle. Alar scales present.

COLOUR : upper $\frac{1}{4}$ brown, remainder of flanks silvery and golden. Caudal fin with faint dusky fringe, other fins hyaline.

IDENTIFICATION. The lectotype has almost the minimum gillraker count cited for this species by Hildebrand (1943) (i.e. 13-17 + 17-21), but otherwise agrees with his description.

Note. Hildebrand (1943, 1964) and others have cited Cuvier as author of the name *Engraulis grossidens*. The name is not given in the 2nd edition of the *Règne Animal*, but first appears in Spix & Agassiz (1829), published a little later in the same year (*vide* Jordan, 1917 : 131). The names given by Spix and Agassiz are variously attributed to one or other author in the text, but there are 18 names for which Cuvier is stated to be author. Nine of these occur in already published works, usually those of Cuvier (i.e. *Règne Animal*, *Hist. Nat. Poiss.*, *Mém. du Museum*). They are all cited as "Cuv.". The remaining nine, however, are cited as "Cuv. in litt.", and these do not appear in any previously published work. It is known that Agassiz, who outlived Spix, prepared the Spix volume for publication actually at the laboratories of the Jardin des Plantes in Paris. As Myers (1956) has pointed out, Agassiz and Cuvier were thus in close contact and each was most likely aware of the others' manuscript. The nine names "in litt." were probably ones that Cuvier intended to use but for some reason did not. They must, therefore, be accepted as validations of Cuvier MS names and should be attributed to Agassiz.

The name *Engraulis grossidens* is an exception. It is cited as "Cuv. in litt.", but it carries a Spix synonym, *Engraulis janeiro*, which is also used in the figure. Clearly, it was Spix, not Agassiz, who drew up the description ; Agassiz merely interposed another and unnecessary name, presumably following Cuvier. Nevertheless, it must be accepted that Agassiz took the final responsibility for giving the species a name and for publishing the name and description.

STOLEPHORUS Lacepède, 1803

Stolephorus Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 381 (Type : *Stolephorus commersonii* Lacepède—see below).

Lacepède included two species in this genus, *Stolephorus commersonii* and *S. japonicus*, the latter based on the poorly described *Atherina japonica* Houttuyn.

Jordan & Gilbert (1883 : 272) designated the later as type of the genus, but its identity was controversial. Jordan (1917 : 67) later believed it to be *Spratelloides argyrotaenia* (i.e. *S. gracilis*), and Fowler (1941 : 561) therefore employed *Stolephorus* as a senior synonym of *Spratelloides* Bleeker, a round herring genus, using his own (Atlantic) genus *Anchoviella* for the Indo-Pacific anchovy group which includes *Stolephorus commersonii*. Fowler evidently overlooked Opinion 93 of the International Commission (*Smithson. Inst. Publ.* 2873, **73** (4), October 1926), which overruled the earlier type designation and settled in favour of *S. commersonii* as type of the genus *Stolephorus*.

The confusion arising from this is evident in the literature, but the problem has now been solved by the ruling given in Opinion 749 (*Bull. zool. Nomencl.*, **22** (4) : 218–219) made in 1965 following an application to suppress *Atherina japonica* Houttuyn as a *nomen dubium* (Whitehead, 1963b). *Stolephorus* now stands as an Indo-Pacific anchovy genus, and the presence of abdominal scutes clearly separates it from *Anchoviella*.

Lacepède (1803) was the first to separate an anchovy from the main body of clupeoids at generic level. At first sight it is curious that he should have chosen *Stolephorus commersonii* but left the very similar *Engraulis encrasicolus* in the genus *Clupea*. The name chosen by Lacepède (στολή + ὄσρος i.e. bearing a stole or white band) suggests, however, that the silver lateral stripe, so similar to that found in the silver-sides (Atherinidae), was the principal reason ; thus *Stolephorus* closely follows *Atherina*, but precedes *Clupea* by forty pages, with the mullets, flying fishes and *Polynemus* in between.

The genus *Stolephorus* was ignored by Cuvier (1817, 1829), Valenciennes (1848) and Günther (1868). Bleeker (1863) was one of the first to use the name *Stolephorus* in its modern sense, i.e. for Indo-Pacific anchovies that lack post-pelvic scutes. Weber & DeBeaufort (1913) accepted this. In the Western Atlantic, *Stolephorus* was used by Bleeker (1866) and later by Jordan & Evermann (1896), until finally replaced by *Anchoviella* Fowler, 1911 and *Anchoa* Jordan & Evermann, 1927. In using *Anchoviella* for Indo-Pacific species of *Stolephorus*, Fowler (1941) ignored the fact that all the New World anchovies are quite distinct from those of the Old World in lacking pre-pelvic and post-pelvic scutes.

Like *Engraulis*, the name *encrasicolus* has long been used as a vernacular name for the European anchovy (greek = gall in head). The brief appearance of *Encrasicolus* Fleming, 1828, was pre-dated by *Encrasicolus* of Commerson, a MS name first published by Lacepède (1803 : 458) in the synonymy of *Clupea vittargentea*. The complete citation is "Encrasicolus mandibula inferiore brevior, taenia laterali argentea". This fish has been identified as possibly a species of *Stolephorus* (see p. 139). Jordan (1917) discussed such Commerson names and considered that those not adopted by Lacepède but published as junior synonyms should not be formally accepted. The International Commission had, at that time, accepted such names (Opinions 23 and 24 in respect of *Antennarius* and *Aspro*), but later the Commerson footnotes were placed on the Official Index of Rejected and Invalid Works in Zoology (List No. 39) (see Opinion 89 and Direction 32).

87. *Stolephorus commersonii* Lacepède, 1803
 = *Stolephorus commersonii* Lacepède, 1803

Stolephorus commersonii Lacepède, 1803, *Hist. Nat. Poiss.*, 5: 381, 382, pl. 12, fig. 1 (on Commerson notes and drawing; *ex* Mauritius in 1770 *vide* Valenciennes 1848: 47).

TYPE MATERIAL. No type material exists and there are no specimens in Paris that could have been examined by Lacepède. There are no specimens in the British Museum from the type locality (Mauritius), or even Madagascar, which could be used for a neotype designation. The species is, however, badly in need of proper definition, and the following description, based on a fish from Tanzania, is intended to illustrate the species as understood by Weber & DeBeaufort (1913), Fowler (1941) and subsequent authors whose descriptions have omitted such essential features as the shapes of the posterior frontal fontanelles and the upper jaw bones, etc.

DESCRIPTION. Based on a fish of 90.2 mm. S.L., *ex* Pangani R. estuary, Tanzania, coll. Merrett, in good condition, BMNH. 1964.12.14.325.

Br.St. 12, D iii 13, P i 12, V i 6, A iii 19, g.r. 19 + 23, scutes 4.

In percentages of standard length: body depth 22.1, head length 24.5, inter-orbital width 6.65; snout length 5.3, eye diameter 6.1, length of upper jaw 22.0, length of lower jaw 15.9; pectoral fin length 14.7, pelvic fin length 9.5, length of anal fin base 20.1; pre-dorsal distance 53.5, pre-pelvic distance 44.9, pre-anal distance 63.0.

Body moderately compressed, its width a little less than half body depth, belly rounded in front of pelvic fins. Head a little longer than body depth; inter-orbital greater than snout length, 3.7 times in head length and slightly greater than eye diameter. Posterior frontal fontanelles 2.5 mm. long, 1.95 mm. wide (at posterior end), lateral margins forming a sigmoid curve (Figure 13b). Upper jaw with fine, even teeth to maxilla tip, the latter almost reaching to edge of operculum;

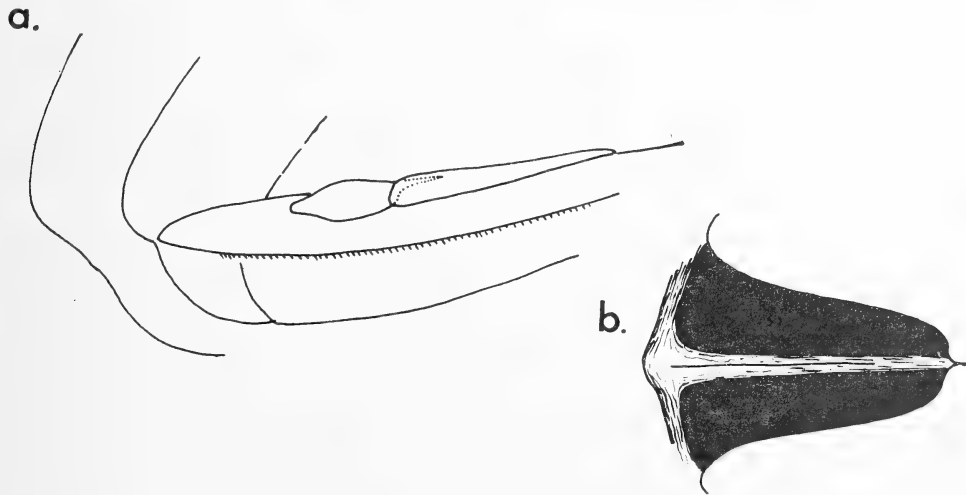


FIG. 13. *Stolephorus commersonii*, suggested neotype, 90.2 mm. S.L. (BMNH. 1964.12.14.325). a. upper jaw (right side). Left maxilla longer, almost to gill opening. b. dorsal view of posterior frontal fontanelles (black).

two supra-maxillae, the 1st (anterior) 5.45 mm. long, the second with the expanded portion 3 times as long as deep, slightly overlapped anteriorly by the 1st supra-maxilla; maxilla projecting 3.6–4.1 mm. (left and right sides) beyond the posterior tip of the 2nd supra-maxilla (Figure 13a). Lower jaw with a single series of fine, even teeth. Pro-otic and pterotic diverticula of swim-bladder present, the latter large, occupying almost the whole of the pre-epiotic fossa.

Pseudobranch present, exposed, just greater than eye diameter. Gillrakers fine, slender, $1\frac{1}{2}$ times length of longest gill filaments, just over $\frac{1}{2}$ eye diameter; gillraker serrae short, in 2–3 rather indistinct lines along inner edge of raker; five short stumps present on posterior face of 3rd epibranchial. Muscular portion of isthmus reaching forward to hind margin of branchiostegal membrane.

Scutes lying between pectoral and pelvic fin bases, a distinct gap between last scute and pelvic scute; spines of scutes needle-shaped, with narrow ascending arms (5 times as long as broad). No pre-dorsal spine or scute-plate; no spine present on pelvic scute.

Dorsal fin origin equidistant between caudal base and anterior border of eye. Pectoral fin tips failing to reach pelvic base by 1 eye diameter; a fleshy axillary process above 1st pectoral ray, $\frac{1}{3}$ length of fin. Pelvic fin base nearer to pectoral base than to anal origin by $\frac{1}{2}$ pupil diameter; last ray on each side joined to body by membrane along $\frac{1}{3}$ – $\frac{1}{2}$ length of ray. Anal fin origin equidistant between pectoral and caudal bases, below vertical from 9th branched dorsal ray.

Colour: uniform light brown, silver lateral stripe not apparent. Posterior margin of caudal with dark fringe, rest of fins hyaline.

IDENTIFICATION. The genus *Stolephorus* has long been in need of revision. This is now being undertaken by Mr. Inocencio Ronquillo, who has graciously allowed me to use some of his preliminary findings. The most important of these is the use of certain new characters to separate the closely related species *Stolephorus indicus* (van Hasselt), *S. commersonii* (Lacepède) and *S. bataviensis* (Hardenberg). All three species lack types and must be redefined through neotype selections. Based on Mr. Ronquillo's study, the three species can be separated by the following key.

- 1 Maxilla usually reaching beyond posterior border of pre-operculum, almost to gill opening, projecting greatly beyond 2nd supra-maxilla
 - a. Lateral borders of posterior frontal fontanelles sigmoid, fontanelles almost as wide as long; supra-orbitals prominent, snout stubby, inter-orbital width equal to distance in front of this point and less than $2\frac{1}{2}$ times in dorsal length of head *S. commersonii*
 - b. Lateral borders of posterior fontanelles straighter, fontanelles much longer than wide; supra-orbitals not prominent, snout longer, inter-orbital width less than distance in front of this point and $2\frac{1}{2}$ –3 times in dorsal length of head *S. bataviensis*
- 2 Maxilla shorter not reaching beyond posterior border of pre-operculum, projecting only a little beyond 2nd supra-maxilla; frontal fontanelles clearly straight-sided, longer than wide *S. indicus*

Stolephorus commersonii and *S. bataviensis* (*S. insularis*) are superficially very similar and the descriptions given by Hardenberg (1933a, 1933b) are not sufficient to distinguish them. It is more than likely that many records of these species have been based on mixed material.

88. *Clupea vittargentea* Lacepède, 1803
Stolephorus or *Engraulis* sp.

Clupea vittargentea Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 424, 458 (on Commerson MS, *Encrasi-cholus mandibula inferiore brevior, taenia laterali argentea, ex Mauritius*).

TYPE MATERIAL. No extant specimens that could have been examined by Lacepède.

IDENTIFICATION. Lacepède's description can be summarized as:

1. Upper jaw in advance of lower, snout projecting
2. Br.St. 12, D 15, P 15, V 7, A 20, C 20
3. Teeth small
4. Silver lateral stripe, opercular series bright silver, much of body transparent
5. Small size
6. Scales deciduous.

This is clearly an engraulid (snout, jaws, high branchiostegal count), and the anal count rules out a species of either *Thrissina* or *Thryssa* (27 or more in these genera). The engraulid fauna of Mauritius is poorly known (Baissac, 1951, lists only two species), but judging by the species found in South Africa and Zanzibar (B.M.N.H. collections), there are four possibilities,

Engraulis capensis Gilchrist (north to Seychelles, Whitehead, 1964b)

Stolephorus commersonii (Lacepède)

Stolephorus indicus (van Hasselt)

Stolephorus buccaneeri Strasburg (Durban fish, Whitehead, 1965b : 269).

Stolephorus buccaneeri has a lower anal count (ii 13-14, Whitehead, 1965b), but the other three are equally possible, all having a silver lateral stripe. Lacepède's statement that in a very short while the belly of the fish turns to *garum* might suggest the fish without abdominal scutes, i.e. *E. capensis*, but this commonly occurs in *Stolephorus* also. *Stolephorus commersonii* might be ruled out as already described from this island by Commerson, but *Clupea vittargentea* is described as small and occurring in myriads along the shore, suggesting juveniles.

One can only conclude that the identity of *Clupea vittargentea* is doubtful. It pre-dates the other names and would become a *nomen oblitum* if it were to supercede them. Although too hasty rejection of a name as a *nomen dubium* is undesirable, positive identification always being a future possibility, there seems little point in retaining a name if its almost certain fate is to become a *nomen oblitum* (*pace* Simpson and Sabrosky, Opinion 749, *Bull. zool. Nomencl.*, 22 (4) : 218-9, 1965). Application will be made to the International Commission to reject this name.

THRISSINA Jordan & Seale, 1925

Thrissina Jordan & Seale, 1925, *Copeia*, No. 141 : 30 (Type : *Clupea baelama* Forsskål).

A single species, *Thrissina baelama*, widespread throughout the Indo-Pacific region and common in most collections of anchovies from that area.

89. *Clupea tuberculosa* Lacepède, 1803
 = *Thrissina baelama* (Forsskål, 1775).

Clupea baelama Forsskål, 1775, *Descript. Animal.*: 72 (Djidda, Red Sea).

Clupea tuberculosa Lacepède, 1803, *Hist. Nat. Poiss.*, 5: 425, 460 (Mauritius; on Commerson).

IDENTIFICATION. Lacepède cites Commerson's description as " *Clupea mandibula inferiore brevior, rostro apice tuberculo verrucaeformi, macula miniata ad superiores branchiarum commissuras* ".

Lacepède's description amounts to:

1. Br.St. 12, D 14, P 14, V 7, A 30
2. Lower jaw behind upper, mouth carried back to below eyes; teeth short, more easily felt than seen
3. Tongue bordered by filaments
4. Tubercle at snout tip
5. Caudal forked
6. Back azure, flanks silvery; dorsal reddish brown, as also caudal; red mark on upper part of pectoral base.

The branchiostegal count and details of the lower jaw indicate an anchovy; in some specimens, the pig-like snout can become constricted and protrude like a tubercle. The high anal count rules out *Engraulis* and *Stolephorus*, but is too low for *Thryssa*. The only species possible is *Thrissina baelama*, and this is the only anchovy from the western Indian Ocean that has definite red or orange marks on the dorsal fin, the caudal base and posterior to the gill opening. I have examined colour photographs of fresh *T. baelama* from Zanzibar and these leave no doubt that this is the fish described by Commerson. Baissac (1951: 129) also records this characteristic colouration in Mauritian specimens.

Note. Valenciennes (1848: 35) recorded this species and his description mentioned a brick-red spot on the scapular; the dorsal and caudal, he stated, were a little lighter (plus claires) than the humeral spot. He recorded material from Mauritius. The species is at present considered well defined, but should the necessity for a neotype for *Clupea tuberculosa* arise, one of the Valenciennes specimens would be suitable.

The Commerson drawing which formed the basis for Lacepède's figure for *Stolephorus commersonii* (see p. 137 and Plate 9c and d) is entitled " *Encrasicholus* " in Commerson's hand, followed by " *Clupea tuberculosa* " in another hand. The latter was evidently added later, and almost certainly not by Lacepède, who kept *Clupea tuberculosa* distinct.

THRYSSEA Cuvier, 1829

Thryssa Cuvier, 1817, *Règne Animal*, 1st ed., 2: 176 (Type: *Clupea setirostris* Broussonet, designated by Jordan, 1917, *Genera of Fishes*, pt. 1: 98) (non *Thryssa* Rafinesque, 1815).

Thryssa Cuvier, 1829, *Règne Animal*, 2nd ed., 2: 323 (Type: *Clupea setirostris* Broussonet).

Thryssus Swainson, 1838, *Nat. Hist. Anim.*, 1: 279 (28) (Type: *Clupea setirostris* Broussonet).

Trichosoma Swainson, 1839, *Nat. Hist. Anim.*, 2: 292 (Type: *Thryssa hamiltonii* Gray).

Thryssocles Jordan & Evermann, 1917, *Genera of Fishes*, pt. 1: 98 (Type: *Clupea setirostris* Broussonet) (substitute for *Thryssa* Cuvier, 1817).

Scutengraulis Jordan & Seale, 1925, *Copeia*, No. 141: 30 (Type: *Thryssa hamiltonii* Gray).

I have shown elsewhere that *Thryssa* is the correct original spelling but is pre-occupied by *Thryssa* Rafinesque, 1815 (a junior synonym of *Clupanodon* Lacepède—see p. 98). Cuvier's *Thryssa* is an unjustified emendation and so is a synonym and not a homonym of *Thryssa*; it is thus available and has priority over the widely used *Thryssocles*.

However, Bory St. Vincent (1823)* designated *Clupea mystus* Linnaeus as type of Cuvier's genus *Thryssa*. It is the first species mentioned (both by Cuvier and Bory), the other two species being referred to by Bory only briefly at the end of the article. The type designation is perfectly clear. Bory states,

IV. Les Thrisses, *Thryssa* . . . L'espèce qui sert de type a ce sous-genre compose le genre *Myste*, *Mystus*, de Lacepède.

Le *Myste*, Lacép., Pois. T. V. pl. 467, Encyc. Pois. pl. 100, f. 401; *Clupea mystus*, L., Gmel., Syst. Nat. XIII, 1, pars 2, pl. 1408.

The description that Bory gives, which emphasizes the "rondeur de la caudale, forchue dans la plupart des autres Clupes" and the anal count of 84-86, show quite clearly that he was referring to a species of *Coilia*, not *Thryssa* as understood here. *Clupea mystus* Linnaeus, based on the pre-Linnaean *Clupea mystus* of Osbeck (1757), was earlier figured by Linnaeus (1754, fig. 12) and there is no doubt that it is *Coilia* (see Plate 11b).

Bory ended the article with a brief paragraph stating that Forsskål's *Boelama*, Broussonet's *Clupea setirostris* and Bloch & Schneider's *Clupea mystax* "sont encore des Thrisses". He felt that *Mystus* should be conserved since the name "Thrysse" had already been used for a "Megalope" (he was here referring to Linnaeus' *Clupea thryssa* and not to *Thryssa* Rafinesque).

Cuvier (1817) defined the genus *Thryssa* as containing fishes with prolonged maxillae, a feature found in species of both *Thryssa* and *Coilia*. He gave *Mystus* Lacepède as a synonym, having accepted the name elsewhere (p. 202) for a siluroid genus. Subsequently (Cuvier, 1829), he placed *Clupea setirostris* before *Clupea mystus* in his list of species, added "ou *Pedda poorawah*, Russel, 190" after *Cl. mystus*, and included a fourth species, *Poorawah*, Russel, 189. Since *Pedda poorawah* as well as *Poorawah* of Russell (1803), are both clearly species of *Thryssa*, not *Coilia*, it can be argued that Cuvier's concept of the genus was not based on a "rat-tailed" anchovy, for he would never have equated the drawing of *Pedda poorawah* (i.e. *Thryssa purava*) with the Linnaean figure of *Mystus clupeoides*, had he compared them even superficially.

It can be said, therefore, that the weight of Cuvier's *Thryssa* leans towards the *Thryssa*-like engraulids, and that Bory's type designation was made before Cuvier had demonstrated this (i.e. in the 2nd edition). Acceptance of Bory's designation leads to nomenclatural confusion, for while *Thryssa* can be replaced once again by *Thryssocles*, *Thryssa* would then become a senior synonym of *Coilia* Gray, 1831. The "rat-tailed" anchovies have been called *Coilia* by almost all authors since Gray, and to substitute the much used (and abused) name *Thryssa* would only create confusion.

* Author of the fish articles in the earlier volumes (1-14) of the *Dictionnaire Classique d'Histoire Naturelle*; those of volumes 15 and 16 were by Lesson (see Whitley, 1935).

Application will be made to the International Commission to reject the type designation of Bory and to accept that of Jordan (1917), so that the name *Thryssa* can continue to be used for the Indo-Pacific anchovies with long maxillae but a normal, forked tail.

Valenciennes combined species of *Thryssa* in his compendium genus *Engraulis*, stating that the elongated maxilla seemed to him to be an artificial character. He included 7 species, all of which are species of *Thryssa* except for the last, the *Clupea mystus* of Linnaeus (= *Coilia mystus*), of which he had no specimens. The latter is fully discussed below (p. 149).

90. *Engraulis dussumieri* Valenciennes, 1848
= *Thryssa dussumieri* (Valenciennes, 1848)

Engraulis dussumieri Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 69 (? specimens, no size or locality ; Dussumier).

TYPE MATERIAL. Bertin (1940) listed no types for *Engraulis dussumieri* but there are two bottles in Paris containing Dussumier specimens purporting to belong to this nominal species.

MNHN. 3239. 2 fishes, 138.2–147.0 mm. S.L., and 1 fish, 167.0 mm. S.L., ex Coromandel, coll. Dussumier (2 specimens of *T. mystax* and 1 specimen *T. purava*).

MNHN. 3238, 4 fishes, 153.0–176.0 mm. S.L., ex Bombay, coll. Dussumier (all *T. purava*).

For reasons given below, these specimens are not considered types of *Engraulis dussumieri*. Instead, a specimen has been chosen from the engraulid material collected by the International Indian Ocean Expedition during a cruise of the *Anton Bruun* off the west coast of India. This fish is suitable for a neotype designation.

DESCRIPTION. *Putative neotype*, a fish of 110.4 mm. S.L., ex Arabian Sea, lat. 20° 22' N, long. 71° 47' E, depth 14 fath., 15 Nov. 1963, Cruise 4B of *Anton Bruun* during Int. Ind. Ocean Exped., in good condition but anterior scales gone, BNMH. 1966.11.30.1.

Br.St. 12, D I iii 11, P i 9, V i 6 (right), i 5 (left), A iii 33, g.r. 16 + 18, scutes 15 + 7.

In percentages of standard length : body depth 28.8, head length 26.3 ; snout length 4.5, eye diameter 5.3, upper jaw length 42.6 (43.8 right), lower jaw length 18.8 ; pectoral fin length 19.8, pelvic fin length 9.8, length of anal fin base 32.6 ; pre-dorsal distance 47.7, pre-pelvic distance 46.7, pre-anal distance 66.5.

Body strongly compressed, its width $3\frac{1}{2}$ times in its depth, belly sharply keeled. Head slightly shorter than body depth. Snout a little shorter than eye diameter. Mouth at an angle of about 30° to the horizontal. Upper jaw with a single series of small fine teeth from pre-maxillae to posterior tips of maxillae ; maxillae reaching $\frac{4}{5}$ (left) and $\frac{6}{5}$ (right) along length of pectoral fin ; 1st (anterior) supra-maxilla absent, 2nd (posterior) supra-maxilla rectangular but set diagonally on maxilla ; a narrow membrane from hind margin of 2nd supra-maxilla along upper edge of maxilla (Figure 14c).

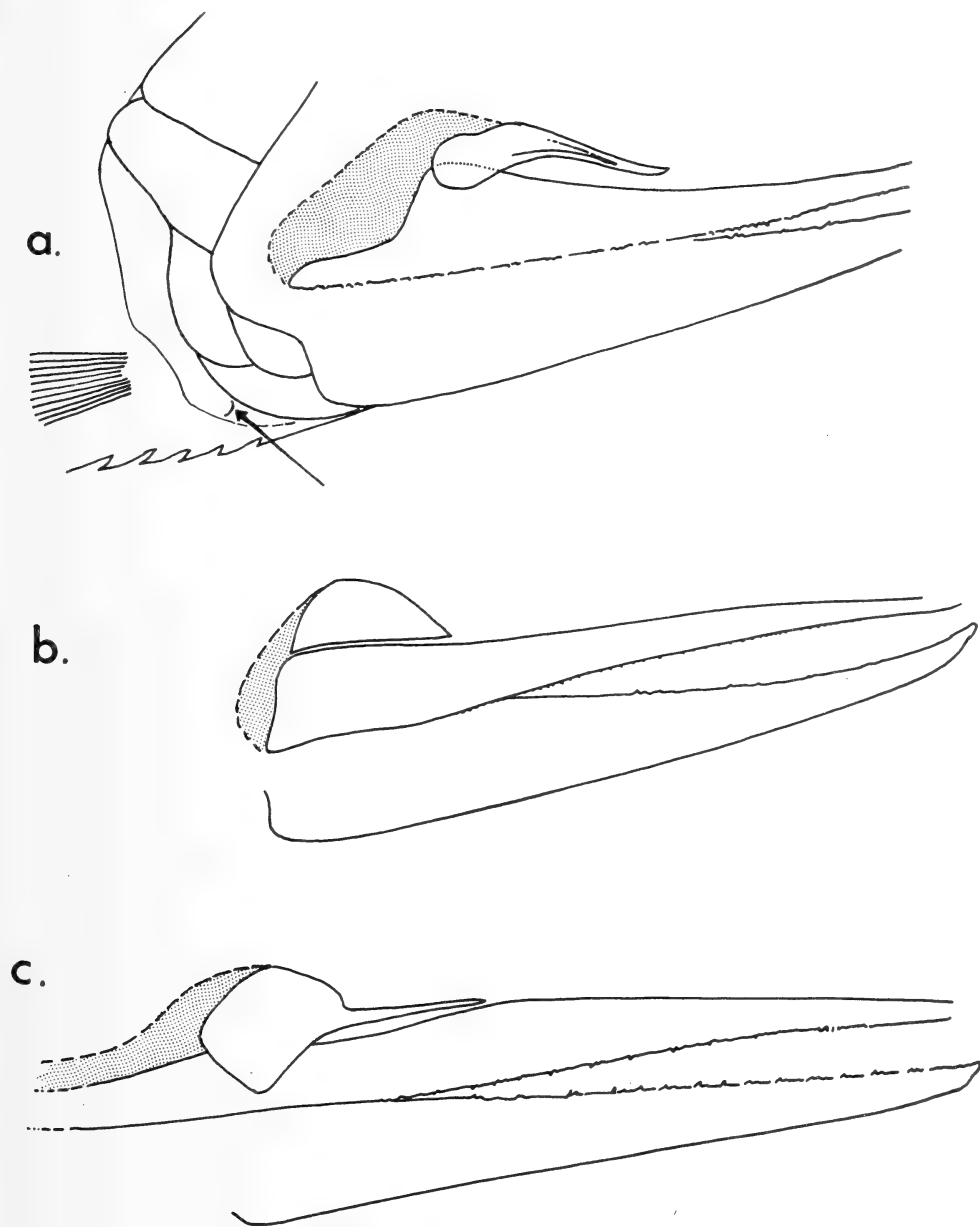


FIG. 14. Upper jaw (right side) showing shape of 2nd supra-maxilla. Fleshy posterior portion of upper jaw stippled. Cleithral pocket shown by arrow. a. *Engraulis brevifilis* holotype (= *Setipinna phasa*), 258 mm. S.L. (MNHN. 3719). b. *Engraulis taty* lectotype (= *Setipinna taty*), 135.5 mm. S.L. (MNHN. 3730). c. *Engraulis dussumieri* putative neotype (= *Thryssa dussumieri*), 110.4 mm. S.L. (BMNH. 1966. 11.30.1).

Pseudobranch present, covered by membrane except for tips of filaments, $\frac{1}{2}$ eye diameter. Gillrakers moderately slender, $1\frac{1}{3}$ times length of gill filaments, equal to eye diameter; serrae on inner faces of gillrakers in up to 8 clumps of longer serrae, interspersed by much smaller serrae; 8 short but well-defined gillrakers on posterior face of 3rd epibranchial.

Dorsal fin preceded by a scute-like plate bearing a short spine; dorsal origin nearer to snout tip than to caudal base by $\frac{3}{4}$ eye diameter; a low scaly sheath at base of fin. Pectoral fin just reaching to pelvic base. Pelvic fin base nearer to pectoral base than to anal origin by $\frac{1}{2}$ pupil diameter. Anal fin origin $\frac{3}{4}$ eye diameter behind vertical from last dorsal ray, equidistant between caudal base and pectoral base; low scaly sheath at base of fin.

Scales with up to 15 vertical striae, straight posteriorly, wavy anteriorly. Hind margin of scale without crenulations.

COLOUR: upper $\frac{1}{3}$ of body grey-brown, remainder of flanks a lighter brown with some silver on lower flanks. Humeral venulose area with longitudinal lines of melanophores. A dark reddish-brown line along base of anal rays. Dark pigmentation at base of caudal rays. Dusky fringe to caudal and dorsal fin.

Note. The Paris specimens have been identified using the key given by Whitehead, *et alii* (1966). The specimens of *Thyssa purava* have anal counts of iii 41, iii 42, iii 44, iii 45 and iii 40 + (damaged). Valenciennes gave a total count of 35, which is nearer to the count in the two specimens of *T. mystax* (iii 30, iii 35). But Valenciennes also stated that the maxilla in his specimen(s) reached $\frac{2}{3}$ or $\frac{3}{4}$ along the pectoral, whereas in none of the specimens does the maxilla extend more than a third of the way along the maxilla. Finally, Valenciennes said that the pelvic fins were not hidden by the pectorals, but in all the Paris specimens the pectoral tips overlap the pelvic base.

The Paris specimens clearly do not form the basis of Valenciennes' description and were probably labelled "*dussumieri*" at a later date. They are not the types, and since Valenciennes merely prefaces his description with "M. Dussumier a encore rapporté une espèce particulière d'Anchois de la division des Thrisses", with no mention of actual specimens, it is probable that the description was based on Dussumier's notes. There are no Paris specimens that correspond to this description.

The only species of *Thyssa* with a long maxilla reaching almost to the pectoral tip (but not beyond—*cf.* *T. setirostris*) is *T. dussumieri*. This species shares with *T. vitirostris* (Gilchrist & Thompson) and also *Setipinna taty*, an unusual arrangement of the serrae on the gillrakers, these being grouped together into clumps of longer serrae (more or less evenly spread in all other species). *Thyssa vitirostris*, originally described from South Africa, has now been recorded from India (Dutt, 1961a). It can be distinguished from *T. dussumieri* by its shorter maxilla ($\frac{1}{3}$ along pectoral), more gillrakers (15–17 + 20–23) and more post-pelvic scutes (10–12) (figures from Dutt, *loc. cit.*).

91. *Clupea chrysoptera* Lacepède, 1803

? *Thryssa* sp.

Clupea chrysoptera Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 425, 460 (? Mauritius ; on Commerson).

IDENTIFICATION. Lacepède cited Commerson's description as " *Encrasicholus platygaster, cauda flavescens* ".

Lacepède's description amounts to :

1. The head of an anchovy, the body of a sardine and the size of a small herring.
2. Back blue mixed with white ; flanks and belly silver ; cheeks and opercular series gold ; a black mark on each side of the body ; fins yellow ; pale flesh-colour inside mouth.
3. Transparent in front of eyes.

This must be accepted as an anchovy. The black marks on each side of the body strongly suggest a species of *Thryssa*, in many of which there is usually some dark pigmentation on the humeral venules. *Thryssa vitirostris* can be eliminated because the gill arches in that species are bright orange and are immediately noticeable when the mouth is opened wide (Dutt, 1961a). The long maxillae of *T. setirostris* and *T. dussumieri* would not have escaped comment. There is nothing in the description that would eliminate any other species of *Thryssa*. The name *Clupea chrysoptera* has not since been cited as a senior synonym and would be a *nomen oblitum* if used for any of the possible known species. It is best regarded as a *nomen dubium*.

TELARA Valenciennes, 1848

= **SETIPINNA** Swainson, 1839

Setipinna Swainson, 1839, *Nat. Hist. Animals*, 2 : 292 (Type : *Setipinna megalura* Swainson = *Clupea phasa* Ham. Buch., designated by Swain, 1882, *Proc. Acad. nat. Sci. Philad.* : 280).

Telara Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 54 (Type : *Clupea telara* Ham. Buch. = *Clupea phasa* Ham. Buch., tautotypic) ; Günther, 1868, *Cat. Fish. Brit Mus.*, 7 : 400.

A key to the five known species of *Setipinna* is given in Whitehead, *et alii* (1966). Cuvier (1829) placed *Clupea phasa* and *C. telara* Ham. Buch. in *Engraulis*. Valenciennes (1848 : 53), stating that too much emphasis should not be given to a single character, i.e. the filamentous first pectoral ray, kept his species in *Engraulis* also. However, he stated that " Les naturalists qui croient devoir le fair [i.e. create a separate genus], pourraient leur donner le nom *Telara*, qui a été imposé par Hamilton Buchanan à l'une de nos espèces. " Fowler (1941 : 686) attributed the name *Telara* to Günther (1868), but Valenciennes clearly defined the genus and proposed a name ; even though he himself did not use it, he suggested its use to other workers.

92. *Engraulis brevifilis* Valenciennes, 1848

= *Setipinna phasa* (Ham. Buch., 1822)

Clupea phasa Hamilton-Buchanan, 1822, *Fishes of the Ganges* : 240, 382 (brackish rivers of Bengal).

Engraulis brevifilis Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 54 (Bengal ; 1 fish, 11 inches ; Duvaucel).

TYPE MATERIAL. *MNHN*. 3719, 1 fish, 258 mm. S.L., *ex* Bengal, coll. Duvaucel (1826).

DESCRIPTION. *Holotype*, a fish of 258 mm. S.L., *ex* Bengal, coll. Duvaucel, scales gone from antero-dorsal region, left side with vertical slit above pelvic base, otherwise in good condition, MNHN. 3719.

Br.St. 13, D I iii 10, P i 13, V i 6, A iii 72, g.r. 15 + 17, scutes 15 + 7.

In percentages of standard length : body depth 26.6, head length 17.8 ; snout length 3.1, eye diameter 3.5, upper jaw length 16.9, lower jaw length 14.3 ; pectoral fin length (including filament) 25.3 (or 18.2 without filament), pelvic fin length 6.4, length of anal fin base 54.0 ; pre-dorsal distance 46.3, pre-pelvic distance 33.5, pre-anal distance 44.6.

Body strongly compressed, its width 5 times in its depth, belly sharply keeled. Snout about equal to eye. Jaws with short, close-set but slightly irregular teeth in a single series extending in the upper jaw to posterior tip of maxilla. Maxilla gradually deepening posteriorly, then becoming abruptly narrow behind 2nd (posterior) supra-maxilla ; maxilla reaching to just beyond articulation of lower jaw but not to hind margin of pre-operculum ; no 1st (anterior) supra-maxilla ; 2nd supra-maxilla curved downwards posteriorly and rounded, tapering evenly to point anteriorly ; a fleshy lobe forming hind end of upper jaw (Figure 14a). Jaws about equal in front. Posterior frontal fontanelles crescentic, almost occluded.

Pseudobranch not seen, probably concealed (as in B.M.N.H. specimens). Gill-rakers moderate, $1\frac{3}{4}$ length of gill filaments, $\frac{4}{5}$ eye diameter ; inner faces of gillrakers with an uneven scattering of large and small serrae, not clumped. A small (2-3 mm.) " pocket " opening backwards and slightly upwards on smooth exposed cleithral area just below level of first pectoral ray (= cleithral pocket).

Dorsal fin preceded by scute-like plate bearing short spine ; dorsal origin above vertical from 7th branched anal ray, nearer to snout tip than to caudal base by $2\frac{3}{4}$ eye diameters. Pectoral fin with filamentous first ray reaching just to anal origin ; first branched ray reaching $\frac{3}{4}$ along pelvic fin ; axillary scale present, $\frac{1}{2}$ length of fin (excluding filament). Pelvic fins nearer to anal origin than to pectoral base by almost 1 eye diameter. Anal fin origin in advance of vertical from dorsal origin by $2\frac{1}{3}$ eye diameters.

COLOUR : upper $\frac{1}{5}$ brown, remainder of flanks golden ; fins hyaline.

IDENTIFICATION. The low pre-pelvic scute count and high anal count place this specimen in *Setipinna phasa*. The shape of the maxilla and 2nd supra-maxilla are also characteristic of this species.

I have been unable to find reference to the " cleithral pocket " mentioned in the description above. It is much better formed than the scale pockets that sometimes occur in this region in *S. taty*, and is present in all British Museum material examined.

93. *Engraulis taty* Valenciennes, 1848
= *Setipinna taty* (Valenciennes, 1848)

Engraulis taty Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 60 (Pondichéry ; some fishes, 6 inches ; Dussumier, Leschenault).

TYPE MATERIAL. MNHN. 3730, 2 fishes, 125.5-135.5 mm. S.L., *ex* Pondicherry, coll. Leschenault (1818).

MNHN. 3729, 1 fish, 110.6 mm. S.L., *ex* Pondicherry, coll. Dussumier (1830).

The Dussumier specimen has a slightly damaged belly, but the Leschenault specimens are in fair condition and the largest is chosen here as lectotype.

DESCRIPTION. (Figures for the other Leschenault specimen given in parentheses.)

Lectotype, a fish of 135.5 mm. S.L., *ex* Pondicherry, coll. Leschenault, anterior scales gone, diagonal slit upwards from vent, paper tag tied to fish, *MNHN*. 3730.

Paralectotype, a fish of 125.5 mm. S.L., *ex* Pondicherry, coll. Leschenault, *MNHN*. 3730.

Br.St. 14 (12), D I ii 12 (iii 12), P i 13 (i 12), V i 6 (i 6), A ii 51 (ii 50), g.r. 16 + 18 (16 + 20), scutes 19 + 11 (28 + 12).

In percentages of standard length : body depth 33.5 (33.3), head length 19.6 (19.5) ; snout length 3.0 (3.2), eye diameter 4.7 (4.6), length of upper jaw 17.9 (17.7), length of lower jaw 15.6 (15.9) ; pectoral fin length (including filament) 65.5 (59.5), pelvic fin length 6.5 (5.6), length of anal fin base 47.8 (50.0) ; pre-dorsal distance 47.5 (46.5), pre-pelvic distance 36.2 (37.7), pre-anal distance 52.3 (50.5).

Body strongly compressed, its width 5 times in its depth, belly sharply keeled. Snout a little shorter than eye diameter, projecting a little beyond tip of lower jaw. Jaws with a single series of small teeth, reaching to posterior tip of maxilla. Maxilla gradually becoming deeper posteriorly, tip truncate, extending little beyond 2nd (posterior) supra-maxilla ; the latter semi-circular, without narrow anterior arm ; no 1st (anterior) supra-maxilla ; a short membrane rounding off tip of upper jaw (Figure 14b). Posterior frontal fontanelles, with sigmoid lateral boundaries, short but not occluded.

Pseudobranch very small, totally covered by membrane, less than $\frac{1}{2}$ eye diameter in length. Gillrakers moderately stout, twice length of gill filaments, $\frac{3}{4}$ eye diameter ; serrae on inner face of rakers in distinct clumps of larger serrae ; about 5 short rakers on posterior face of 3rd epibranchial. No cleithral pocket (see previous species).

Dorsal fin preceded by scute-like plate bearing a short spine ; dorsal origin nearer to snout tip than to caudal base by 2 eye diameters. Pectoral fin with first unbranched ray filamentous, its tip reaching $\frac{3}{4}$ along anal fin. Pelvic fin base nearer to anal origin than to pectoral base by $\frac{1}{2}$ eye diameter ; a fleshy pigmented appendage below each fin extending posteriorly. Anal fin origin nearer to snout tip than to caudal base by $\frac{1}{2}$ eye diameter, below vertical from 3rd branched dorsal ray ; base of fin with low scaly sheath.

COLOUR : upper $\frac{1}{5}$ brown, remainder of flanks silver, or golden where scale cover retained. Fins hyaline.

Note. The single Dussumier specimen has 18 + 11 scutes and an anal count of iii 48, placing it in *Setipinna taty*.

94. *Engraulis tenuifilis* Valenciennes, 1848
= *Setipinna taty* (Valenciennes, 1848)

Engraulis tenuifilis Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 62 (Rangoon ; 2 fishes, $4\frac{1}{2}$ inches ; Reynaud).

TYPE MATERIAL. *MNHN*. 3731, 2 fishes, 104.8–108.8 mm. S.L., *ex* Irrawady

river, Rangoon, coll. Reynaud, a few scales remain on body, tip of upper caudal lobe broken, paper tag attached, MNHN. 3731.

Br.St. 15, D I ii 12, P i 11, V i 6, A iii 52, g.r. 11 + 14, scutes 19 + 7.

In percentages of standard length : body depth 30.7, head length 21.3 ; snout length 3.6, eye diameter 4.8, length of upper jaw 19.3, length of lower jaw 18.2 ; pectoral fin length 36.5, pelvic fin length 7.1, length of anal base 48.0 ; pre-dorsal distance 51.0, pre-pelvic distance 35.3, pre-anal distance 47.2.

Body strongly compressed, its width $5\frac{1}{2}$ times in its depth, the latter greater than head length. Snout a little shorter than eye diameter, projecting a little beyond tip of lower jaw. Details of jaw teeth and shape of maxilla and 2nd supra-maxilla exactly as in types of *E. taty*.

Pseudobranch not seen, probably concealed by membrane. Gillrakers moderately stout, $2\frac{1}{2}$ times length of gill filaments, $\frac{3}{4}$ eye diameter ; serrae on inner faces of gillrakers "clumped". Gill opening not completely covered by opercular series.

Dorsal fin preceded by scute-like plate bearing spine, dorsal origin nearer to snout tip than to caudal base by 1 eye diameter. Pectoral fin reaching $\frac{1}{4}$ along anal fin base. Pelvic fin base nearer to anal origin than to pectoral base by $\frac{1}{2}$ eye diameter. Anal origin nearer to snout tip than to caudal base by $1\frac{1}{2}$ eye diameters.

COLOUR : upper $\frac{1}{5}$ brown, remainder of flanks silver, or golden where scale cover retained. Fins hyaline.

IDENTIFICATION. Both specimens closely resemble the types of *Setipinna taty*. This species differs from *S. phasa* not only in scute and anal ray counts, but also in the very different shape of the maxilla and 2nd supra-maxilla. In some British Museum specimens scale pockets occur within the rim of the gill opening, but such pockets are not as well defined as the cleithral pocket described here in the type of *Engraulis brevifilis*.

MYSTUS Lacepède, 1803 = **COILIA** Gray, 1831

[*Mystus* Linnaeus, 1754, *Chinensia Lagerströmiana*—*Dissertatio* : 26, fig. 12 (Type : *Mystus ensiformis* Linnaeus = *Clupea mystus* Linnaeus)].

Mystus Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 466 (Type : *Mystus clupeoides* Lacepède = *Clupea mystus* Linnaeus) (pre-occupied by Gronow, 1763 ; Klein, 1775 ; Scopoli, 1777).

Coilia Gray, 1830, *Illustr. Ind. Zool.*, 1, pt. 1 : pl. 85, fig. 3 (caption only) ; 1831, *Zool. Misc.* : 9 (Type : *Coilia hamiltonii* Gray = *Mystus ramcarati* Ham. Buch.).

Lacepède (1803) clearly based his genus *Mystus* on a species of *Coilia* (see below), but this name was preoccupied. As shown elsewhere (p. 141), the type designation of Bory St. Vincent (1823) makes *Thryssa* Cuvier the next available name, but application is being made to suppress this designation on grounds of stability. *Coilia* Gray has been consistently used for the rat-tailed anchovies for over a century and should be retained. Linnaeus (1754) used the name *Mystus ensiformis* for a species that he subsequently described as *Clupea mystus* = *Coilia mystus* (Linnaeus, 1758). This early use of *Mystus* as a generic name for a rat-tailed anchovy is inadmissible (pre-1758).

One attempt to split *Coilia* was Jordan & Seale's genus *Demicoilia*, for species with truncate caudal peduncles. This condition is, however, almost certainly an artifact, resulting from damage and regeneration (Jones & Menon, 1952).

Leptonurus Bleeker, founded on a species with light organs, may provide a more realistic division of the genus *Coilia*, perhaps at subgeneric level. *Coilia quadragesimalis* Valenciennes, the type species of *Demicoilia*, has no light organs and would not be included in *Leptonurus*.

The genus is greatly in need of revision, particularly the Indian species not included by Whitehead (1966a) and Whitehead, *et alii* (1966). The identity of the type of *Coilia* is problematical. It is based solely on a drawing by Gray (1830, pl. 85, fig. 3) and shows a fish with 7 pelvic rays, but resembling *Coilia ramcarati* (Ham. Buch.) (pelvic 9–10). It has only 4 pre-pelvic scutes (as in *Coilia reynaldi*) but only 6 free pectoral filaments (10–14 in *C. reynaldi*). It resembles *C. dussumieri* but lacks pearly spots. It can be identified as *C. ramcarati*, with the pelvic rays misdrawn, a conclusion also reached by Fowler (1941) and confirmed by the original Hardwicke drawing in this museum (pelvic rays 9).

95. *Mystus clupeioides* Lacepède, 1803
= *Coilia mystus* (Linnaeus, 1758)

[*Mystus ensiformis* Linnaeus, 1754, *Chinensia Lagerströmiana*—*Dissertatio* : 26, fig. 12—East Indies.]

[*Clupea mystus* Osbeck, 1757, *Dagbok Ostind. Resa* : 256—Canton area.]

Clupea mystus Linnaeus, 1758, *Syst. Nat.*, 10th. ed.: 319 (on Osbeck and Lagerström descriptions); *Idem*, 1759, *Amoen. Acad.*, 4 (61) : 252, fig. 12 (repeat of 1754 descr. and fig.) ; Cuvier, 1817, *Règne Animal*, 1st ed., 2 : 176 (on Linnaeus, 1759) ; *Idem*, 1829, *ibid*, 2nd ed., 2 : 323 (equated with *Pedda Poorawah* of Russell, 1803).

Mystus clupeioides Lacepède, 1803, *Hist. Nat. Poiss.*, 5 : 466, 467 (sea of the Indies ; chiefly on Osbeck).

Engraulis mystus Valenciennes, 1848, *Hist. Nat. Poiss.*, 21 : 73 (on Linnaeus, 1754 and Dussumier drawing).

TYPE MATERIAL. There are no specimens in Paris that could have formed the basis of Lacepède's description of *Mystus clupeioides*.

IDENTIFICATION. Lacepède (1803 : 467) added nothing to previous descriptions of this species beyond giving it another name. His meristic counts correspond exactly with the Osbeck counts cited by Linnaeus (1758). There is little reason to think that Lacepède had material, particularly since Valenciennes (1848 : 74) stated that he too had seen no specimens. Günther (1868 : 404) and subsequent authors have accepted *Mystus clupeioides* as a junior synonym of *Clupea mystus*.

Lönnberg (1896) identified as type of *Clupea mystus* Linnaeus an Uppsala specimen, which was labelled (wrongly, he claimed) "*Clupea encrasicolus* Mus. Lin.", stating that it was in fact from the Lagerström collection. He distinguished *Coilia mystus*, with 7 free pectoral filaments, from *Coilia clupeioides* Lacepède (6 filaments). But Lacepède did not mention pectoral filaments (presumably because Linnaeus did not), and a review of the literature (Whitehead, 1966a : 42) shows that fishes with 6 or 7 filaments have been variously ascribed to *C. mystus*, *C. clupeioides*, *C. grayii*, *C. playfairii*, etc. A variation of one ray is probably not significant.

The identity of the Linnaean species is not easy to determine. Fowler (1941) listed three other species with a long maxilla (to pectoral base in Linnaeus' figure), viz. *C. macrognathos* Blkr., *C. grayii* Rich. and *C. lindmani* Blkr. All have a high coronoid process in the lower jaw, a feature not apparent in the figure of *C. mystus*. Also, all have more than 10 pre-pelvic scutes, whereas the figure of *Clupea mystus* shows 3 + 11 scutes (1754 version) or 4 + 13 scutes (1759 version, figure redrawn). The crudity of the drawing suggests that scute number should be ignored, as also the apparent absence of free pectoral filaments.

Until the supposed Linnaean holotype can be redescribed and its type status confirmed, *Coilia mystus*, and thus *Mystus clupeoides* Lacepède, can be assumed to be conspecific with *Coilia grayii* Richardson, for which there is an extant holotype, recently redescribed (Whitehead, 1966a).

Note. Valenciennes (1848), who recognized a distinct genus *Coilia* containing 6 species, nevertheless included *Clupea mystus* of Linnaeus (1754 and 1759) in the *Thryssa* division of his genus *Engraulis*. But he considered Osbeck's *Clupea mystus* to be a true *Coilia*. He based this conclusion mainly on a drawing sent to him by Dussumier, which he claimed represented the *Clupea mystus* of Linnaeus before the Osbeck elements had been added. As described by Valenciennes, this Dussumier drawing seems to have shown a *Coilia* with a truncate caudal fin and no (? damaged) pectoral filaments. Since the Linnaeus figure also shows this, it is not surprising that Valenciennes should have failed to recognize this as a member of *Coilia*. The Linnaeus figure, and the notes on the supposed type of Lönnberg (1896), show that Valenciennes was wrong.

Cuvier (1817) listed *Clupea mystus* of Linnaeus, 1759 (i.e. including figure) as the first of his three species of *Thryssa*. Later (Cuvier, 1829) he equated this species with Russell's *Pedda Poorawah* (see Table 2). Valenciennes correctly pointed to the very great discrepancy between the anal counts in these two nominal species (84 versus 55), but he merely used this as an argument against acceptance of the genus *Thryssa*.

96. *Coilia reynaldi* Valenciennes, 1848
= *Coilia reynaldi* Valenciennes, 1848

Coilia reynaldi Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 81 (Rangoon ; 3 fishes, to 4 inches ; Reynaud).

TYPE MATERIAL. MNHN. 3733, 4 fishes, 74.2–106.0 mm. tot.l., ex Irrawady River, Rangoon, coll. Reynaud (1829).

One of these specimens has a malformed head and may not have been included by Valenciennes. A specimen of 106.0 mm. tot.l. has been chosen as lectotype.

DESCRIPTION. *Lectotype*, a fish of 97.0 mm. S.L., 106.0 mm. tot.l., ex Irrawady River, Rangoon, coll. Reynaud, in moderate condition but apparently dried out at one time, scales missing in front of dorsal fin, MNHN. 3733.

Br.St. 10, D I iii 11, P 11 free + 6, V i 6, A ii 58 (4 missing) 2 (1 missing) 46 = total III, g.r. 21 + 30, scutes 6 + 9.

In percentages of standard length : body depth 17.1, head length 16.0 ; snout length 4.1, eye diameter 3.1, upper jaw length 13.6, lower jaw length 11.1 ; pectoral fin length 34.5, pelvic fin length 9.9, length of anal fin base 66.2 ; pre-dorsal distance 26.9, pre-pelvic distance 22.5, pre-anal distance 32.6.

Body behind pectoral base compressed, elongated, caudal apparently not damaged or regenerated. Head about equal to body depth. Snout a little longer than eye diameter. Lower jaw slender, coronoid process low, a few small teeth along edge

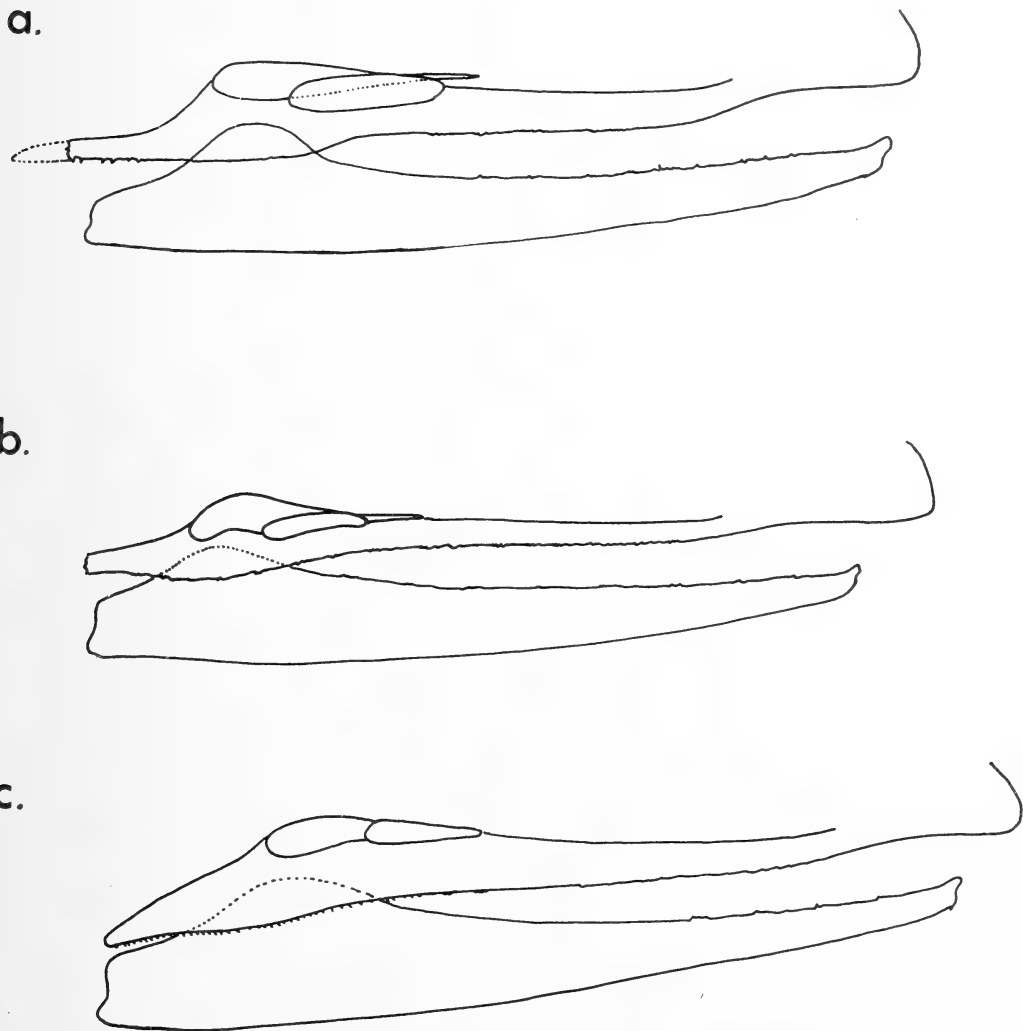


FIG. 15. Upper jaw (right side) showing shape of supra-maxillae. a. *Coilia reynaldi* lectotype (= *C. reynaldi*), 97.0 mm. S.L. (MNHN. 3733). b. *Coilia dussumieri* lectotype (= *C. dussumieri*), 155.4 mm. S.L. (MNHN. 3749). c. *Coilia quadragesimalis* holotype (= *C. ramcarati*), 135.0 mm. S.L. (MNHN. 3734).

of jaw. Maxilla reaching to half-way across pre-operculum but not quite to gill opening, with fine teeth posteriorly; maxilla expanded opposite supra-maxillae but becoming slender posterior to this; two supra-maxillae, the 1st (anterior) about 5 times as long as deep, covering the anterior part of the 2nd, the latter rounded posteriorly and tapering evenly anteriorly (Figure 15a).

Pseudobranch not found, possibly present but covered by tissue. Gillrakers slender, about 3 times as long as gill filaments and equal to eye diameter; no gillrakers on posterior face of 3rd epibranchial.

Dorsal fin preceded by small scute-like plate bearing a short spine; first unbranched dorsal ray minute. Pectoral fin with upper 11 rays free, the longest reaching to base of 30th branched anal ray. Pelvic tips failing to reach anal fin origin by 1 eye diameter. Anal fin origin 1 eye diameter behind vertical from last dorsal ray; fin a little damaged but full count of rays still possible (Valenciennes gives 110).

Scales keeled, beginning under pectoral fins but not reaching forward to isthmus.

IDENTIFICATION. The lectotype very closely resembles *Coilia borneensis* Bleeker, 1851, for which a putative neotype was described by Whitehead, *et alii* (1966). Fowler (1941: 713) distinguished the two on anal counts and there is indeed a difference between the types,

C. borneensis (putative neotype) ii 78 (82–87 *vide* Fowler)

C. reynaldi (lectotype) ii 111 (116 *vide* Fowler)

This difference can, however, be attributed to caudal damage in the specimen of *Coilia borneensis*, in which the body does not taper to a point but is 4.3 mm. deep at the caudal base. As stated earlier, such damage is common amongst specimens of *Coilia*.

Coilia borneensis is almost certainly a synonym of *C. reynaldi*. It differs slightly in two respects. The posterior supra-maxilla curves downwards at its tip, and the pseudobranch is present and exposed. The apparent absence of a pseudobranch in the lectotype of *C. reynaldi* may be a preservation artifact (it is difficult to see in *C. borneensis* in any case), and the 2nd supra-maxilla may vary somewhat in shape.

Jones & Menon (1952) have shown that *Coilia reynaldi* is the commonest species in the Hooghly river and have given a good account of its systematics and biology.

97. *Coilia quadragesimalis* Valenciennes, 1848

= *Coilia ramcarati* (Ham. Buch., 1822)

Mystus ramcarati Hamilton-Buchanan, 1822, *Fishes of the Ganges*: 233 (Ganges estuaries).

Coilia quadragesimalis Valenciennes, 1848, *Hist. Nat. Poiss.*, **21**: 83 (Ganges; 1 fish of 6 inches; Dussumier).

Coilia hamiltoni: Valenciennes, 1848, *Hist. Nat. Poiss.*, **21**: 79 (Ganges; fishes to 7½ inches; Reynaud and Dussumier).

TYPE MATERIAL. *MNHN*. 3734, 1 fish, 135.0 mm. S.L., *ex* Ganges Delta, coll. Dussumier (1830).

DESCRIPTION. *Holotype*, a fish of 135.0 mm. S.L. (163.5 mm. tot.l.), *ex* Ganges Delta, coll. Dussumier, left pectoral damaged, caudal region evidently regenerated after damage, MNHN. 3734.

Br.St. 10, D I iii 13, P 6 free + 6, V i 8 (both), A ii 41, g.r. 21 + 32, scutes 5 + 10.

In percentages of standard length : body depth 25.7, head length 22.7 ; snout length 3.3, eye diameter 3.7, length of upper jaw 17.9, length of lower jaw 16.4 ; length of longest pectoral filament 61.8, length of pelvic fin 9.3 (tips broken slightly), length of anal base 44.7 ; pre-dorsal distance 39.3, pre-pelvic distance 33.5, pre-anal distance 56.2.

Body compressed behind pectoral fin base, belly rounded before pelvic fin base, sharply keeled behind. Caudal region not tapering almost to a point but 8.0 mm. deep at caudal peduncle ; pattern of caudal rays gives a strong impression that caudal regeneration has occurred. Snout a little shorter than eye diameter. Jaws equal anteriorly. Lower jaw slender, without high coronoid process, with a single series of small teeth throughout its length. Upper jaw similarly toothed ; maxilla almost reaching to articulation of lower jaw, becoming expanded below the supra-maxillae but thereafter rapidly tapering to point posteriorly ; 1st (anterior) supra-maxilla rectangular, about 3 times as long as deep, 2nd (posterior) supra-maxilla partly covered by the 1st and curving downwards at tip (Figure 15c).

Pseudobranch present, exposed and moderately long but with extremely short filaments widely spaced. Gillrakers slender, twice length of corresponding gill filaments, equal to eye diameter ; no gillrakers on posterior face of 3rd epibranchial.

Scutes beginning behind pectoral base, becoming more distinctly keeled posteriorly.

Dorsal fin preceded by scute-like plate bearing a short spine. Pectoral fin with 6 long and free filaments, the tip of the longest reaching to the base of the 20th anal ray. Pelvic fin base nearer to pectoral fin base than to origin of anal fin by $2\frac{1}{2}$ eye diameters. Anal fin origin behind vertical from last dorsal ray by $2\frac{1}{2}$ eye diameters.

COLOUR : whole body brown except where scales present, the latter having a pearly sheen. No light organs or regular rows of pearly spots.

IDENTIFICATION. *Coilia ramcarati* is the only species of *Coilia* with more than 16 pelvic rays, and the present specimen must, therefore, be assigned to that species. Jordan & Seale (1925), apparently without seeing the type, named *Coilia quadragesimalis* as type of their new genus, *Demicoilia*, which was defined as having a deep caudal peduncle. As shown by Jones & Menon (1952), a truncate caudal peduncle is the result of previous damage and subsequent regeneration of the tail. A finely tapering body is thus normal in all species of *Coilia*. Jordan & Seale (1926) described a second species of *Demicoilia*, *D. margaritifera*, based on a single specimen from Ceylon. Once again the caudal peduncle was deep, although in this case the regeneration had occurred more posteriorly than in *C. quadragesimalis*. *Demicoilia* must be placed in the synonymy of *Coilia*, the two sharing the same type species. Fowler (1941 : 713) synonymized *Demicoilia margaritifera* with *Coilia quadragesimalis*, but the former is described as having series of pearly or golden spots along the flanks and is *Coilia dussumieri* (see next species).

98. *Coilia dussumieri* Valenciennes, 1848
 = *Coilia dussumieri* Valenciennes, 1848

Coilia dussumieri Valenciennes, 1848, *Hist. Nat. Poiss.*, **21** : 81, pl. 610 (Bombay ; some fishes, to 6 inches ; Dussumier).

TYPE MATERIAL. MNHN. 3749, 4 fishes, 127.7–173.6 mm. tot.l., ex Bombay, coll. Dussumier.

MNHN. 3718, 3 fishes, 155.3–176.0 mm. tot.l., ex Cannanore, coll. Dussumier (the middle fish is 143.4 mm. S.L., but has a damaged and regenerated caudal).

From these, the largest of the Bombay specimens is chosen as lectotype.

The locality Cannanore is not mentioned by Valenciennes, but since these fishes were also collected by Dussumier they must have been examined by Valenciennes.

DESCRIPTION. *Lectotype*, a fish of 155.4 mm. S.L. (173.6 mm. tot.l.), scales missing beyond anal origin, otherwise in good condition, bearing paper tag, MNHN. 3749.

Br.St. 10, D I iii 12, P 6 free + 10, V i 6, A ii 100 (? 1 or 2 rays missing), g.r. 17 + 12, scutes 5 + 8.

In percentages of standard length : body depth 19.7, head length 17.4 ; snout length 3.4, eye diameter 4.2, length of upper jaw 16.1, length of lower jaw 12.9 ; longest pectoral filament 39.8, length of pelvic fins 5.7, length of anal fin base 60.0 ; pre-dorsal distance 28.5, pre-pelvic distance 27.2, pre-anal distance 38.8.

Body compressed behind pectoral base, its width $3\frac{1}{4}$ times in its depth, the latter about equal to head length ; body tapering posteriorly almost to a point, caudal region evidently undamaged. Snout a little shorter than eye diameter. Lower jaw not reaching to tip of snout, slender and without high coronoid process ; a single series of fine teeth present. Maxilla tip apparently slightly damaged but probably reaching just to gill opening ; maxilla becoming gradually expanded to below 2nd supra-maxilla, then tapering to point ; maxilla and pre-maxilla with a single series of fine teeth ; 1st (anterior) supra-maxilla 4 times longer than deep, tapering slightly anteriorly, 2nd (posterior) supra-maxilla curving downwards posteriorly (Figure 15b).

Pseudobranch not found. Gillrakers slender, $2\frac{1}{4}$ times length of corresponding gill filaments, $\frac{3}{4}$ eye diameter ; no gillrakers present on posterior face of 3rd epibranchial.

Scutes beginning behind pectoral fin base, becoming more keeled posteriorly. Muscular portion of isthmus scaled entirely.

COLOUR : body brown, with the following series of silvery spots :

- a. 24 large spots forming a longitudinal midlateral series on a level with eye, extending from gill opening to beyond anal origin.
- b. 2 spots below anterior part of above series.
- c. 11 irregular spots below this forming an uneven line.
- d. 5 spots below this, in front of pelvic base, and 4 spots behind pelvic base.
- e. a deeper-lying series of 11 small spots continued from series c.
- f. 2 large spots on each side of midline between pectoral bases.
- g. about 7 small spots scattered on isthmus.

IDENTIFICATION. The silvery spots along the flanks of this species (see Plate 11c) have been identified as light organs (Haneda, 1961). *Coilia dussumieri* is a senior synonym of *Leptonurus chrysostigma* Bleeker, type species of Bleeker's genus *Leptonurus*, and it appears to be the only species of *Coilia* with light organs. Future work may justify resurrection of the name *Leptonurus* as a subgenus, but at present there seems to be little justification for this. *Demicoilia margaritifera* Jordan & Seale is almost certainly *Coilia dussumieri*.

TABLE I.

The clupeoid genera and species listed by Lacepède (1800, 1803)

* new species or genus

Vol. 2	Lacepède name	Name accepted here
220	* <i>Odontognathus</i>	<i>Odontognathus</i> Lacep., 1800
I. (220) 221	* <i>Odontognathus mucronatus</i>	<i>Odontognathus mucronatus</i> Lacep., 1800
Vol. 5		
381	* <i>Stolephorus</i>	<i>Stolephorus</i> Lacep., 1803
2. (381) 382	<i>Stolephorus japonicus</i>	doubtful—on <i>Atherina japonica</i> Houttuyn†
3. (381) 382	* <i>Stolephorus commersonii</i>	<i>Stolephorus commersonii</i> Lacep., 1803
and pl. 12, fig. 1		
423	<i>Clupea</i>	(compendium genus)
4. (423) 427	<i>Clupea harengus</i>	<i>Clupea harengus</i> Lin., 1758
5. (423) 444	<i>Clupea sprattus</i>	<i>Sprattus sprattus</i> (Lin., 1758)
6. (423) 447	<i>Clupea alosa</i>	<i>Alosa alosa</i> (Lin., 1758)
7. (424) 452	* <i>Clupea fallax</i>	<i>Alosa fallax</i> (Lacep., 1803)
8. (424) 452	* <i>Clupea rufo</i>	<i>Alosa fallax</i> (Lacep., 1803)
9. (424) 455	<i>Clupea encrasicolus</i>	<i>Engraulis encrasicolus</i> (Lin., 1758)
10. (424) 458	<i>Clupea atherinoides</i>	<i>Pterengraulis atherinoides</i> (Lin., 1758)
11. (424) 458	* <i>Clupea vittargentea</i>	<i>Stolephorus</i> or <i>Engraulis</i> sp.
12. (424) 458	<i>Clupea cyprinoides</i>	<i>Megalops cyprinoides</i> (Brouss., 1782)
and pl. 13, fig. 3		
13. (425) 459	<i>Clupea setirostris</i>	<i>Thryssa setirostris</i> (Brouss., 1782)
14. (425) 459	<i>Clupea dorab</i>	<i>Chirocentrus dorab</i> (Forssk., 1775)
15. (425) 459	<i>Clupea malabarica</i>	<i>Thryssa malabarica</i> (Bloch, 1795)
16. (425) 460	* <i>Clupea tuberculosa</i>	<i>Thrissina baelama</i> (Forssk., 1775)
17. (425) 460	* <i>Clupea chrysoptera</i>	? <i>Thryssa</i> sp. (see p. 145)
18. (425) 460	* <i>Clupea fasciata</i>	<i>Leiognathus</i> sp. (fide Jordan, 1917, p. 71)
19. (425) 460	* <i>Clupea macrocephala</i>	<i>Albula vulpes</i> (Lin., 1758)
20. (426) 460	<i>Clupea tropica</i>	probably not a clupeoid (see pp. 16, 113)
466	* <i>Mystus</i>	<i>Coilia</i> Gray, 1831 (<i>Mystus</i> preoccupied)
21. (466) 467	* <i>Mystus clupeoides</i>	<i>Coilia mystus</i> (Lin., 1758)
468	* <i>Clupanodon</i>	<i>Clupanodon</i> Lacep., 1803
22. (468) 470	<i>Clupanodon thrissa</i>	<i>Clupanodon thrissa</i> (Lin., 1758)
23. (468) 470	<i>Clupanodon nasica</i>	<i>Nematalosa nasus</i> (Bloch, 1795)
24. (468) 471	<i>Clupanodon pilchardus</i>	<i>Sardina pilchardus</i> (Walb., 1792)
25. (468) 471	<i>Clupanodon sinensis</i>	<i>Hilsa kelee</i> (Cuvier, 1829)
26. (469) 471	<i>Clupanodon africanus</i>	<i>Ilisha africana</i> (Bloch, 1795)
27. (469) 471	* <i>Clupanodon jussieu</i>	nomen dubium (see p. 54)
pl. 11, fig. 2	(var. <i>chinois</i>)	<i>Sardinella</i> sp. (see p. 56)
pl. 11, fig. 3	(var. <i>jussieu</i>)	<i>Sardinella melanura</i> (Cuvier, 1829)

† Name suppressed by International Commission, Opinion 749 (1965). See discussion in Whitehead (1963b).

TABLE 2.

Clupeoid species listed by Cuvier in the *Règne Animal*

* new species and genera, all in 2nd edition

† listed both in 1st edition (1817) and 2nd edition (1829)

‡ listed only in 1st edition

ftn. listed only in footnote

DES CLUPES

LES HARENGS (*CLUPEA* L.)

Modern name

Les Harengs proprement dits (*Clupea* Cuv.)

- | | |
|--|---|
| †1. <i>Clupea harengus</i> L. | <i>Clupea harengus</i> Lin., 1758 |
| †2. <i>Clupea sprattus</i> Bl. 292 | <i>Sprattus sprattus</i> (Lin., 1758) |
| *3. <i>Clupea latulus</i> (ftn.) | <i>Clupea harengus</i> Lin., 1758 (<i>fide</i> Storey, 1938) |
| *4. <i>Clupea clupeiola</i> Cuv. (ftn.) | <i>Harengula clupeiola</i> (Cuv., 1829) |
| *5. <i>Clupea humeralis</i> Cuv. (ftn.) | <i>Harengula humeralis</i> (Cuv., 1829) |
| *6. <i>Clupea melanura</i> Cuv. (ftn.) | <i>Sardinella melanura</i> (Cuv., 1829) |
| *7. <i>Clupea coval</i> Cuv. (ftn.) | ? <i>Sardinella</i> (<i>nom. dub. fide</i> Whitehead, 1964c) |
| †8. <i>Clupea pilchardus</i> Bl. 406 | <i>Sardina pilchardus</i> (Walb., 1792) |
| 9. <i>Clupea sardina</i> N | <i>Sardina pilchardus</i> (Walb., 1792) |
| 10. <i>Clupea melastoma</i> Schn. (ftn.) | <i>Pellona ditchela</i> Val., 1847 |
| or "Jangarloo" Russ. 191 | <i>Ilisha megaloptera</i> (Swain., 1839) |
| 11. "Ditchoee" of Russ. 192 | <i>Ilisha indica</i> (Swain., 1839) |

Les Aloses (*Alosa* N.)

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| †12. <i>Clupea alosa</i> L. | <i>Alosa alosa</i> (Lin., 1758) |
| *13. <i>Clupea finta</i> N. <i>C. ficta</i> Lac. | <i>Alosa fallax</i> (Lac., 1803) |
| 14. <i>Clupea vernalis</i> Mitch. (ftn.) | <i>Alosa pseudoharengus</i> (Wilson, 1811) |
| 15. <i>Clupea aestivalis</i> Mitch. (ftn.) | <i>Alosa aestivalis</i> (Mitch., 1814) |
| 16. <i>Clupea menhaden</i> Mitch. (ftn.) | <i>Brevoortia tyrannus</i> (Latrobe, 1802) |
| 17. <i>Clupea matowaca</i> Mitch. (ftn.) | <i>Alosa mediocris</i> (Mitch., 1814) |
| *18. <i>Clupea palasah</i> Cuv. (ftn.) | <i>Hilsa ilisha</i> (Ham. Buch., 1822) |
| *19. <i>Clupea kelee</i> Cuv. (ftn.) | <i>Hilsa kelee</i> (Cuv., 1829) |
| 20. <i>Clupanodon ilisha</i> Ham. Buch. (ftn.) | <i>Hilsa ilisha</i> (Ham. Buch., 1822) |
| 21. <i>Clupanodon champole</i> Ham. Buch. (ftn.) | <i>Anodontostoma champole</i> (Ham. Buch., 1822) |
| ‡22. <i>Clupea chinensis</i> Bl. (ftn.) | <i>Hilsa kelee</i> (Cuvier, 1829) |
| ‡23. <i>Clupea africana</i> Bl. (ftn.) | <i>Ilisha africana</i> (Bloch, 1795) |

Les Cailleu-Tassarts (*Chatoessus* Cuv.)*

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|---|--|
| 24. <i>Clupea thrissa</i> Bl. 404, 3 (ftn.) | <i>Clupanodon thrissa</i> (Lin., 1758) |
| 25. "Peddakome" Russ. 197 (ftn.) | <i>Nematalosa come</i> (Rich., 1846) |
| 26. <i>Megalops oglina</i> Lesueur (ftn.) | <i>Opisthonema oglinum</i> (LeSueur, 1817) |
| 27. <i>Megalops notatus</i> Lesueur (ftn.) | <i>Opisthonema oglinum</i> (LeSueur, 1817) |
| 28. <i>Megalops cepedianus</i> LeSueur (ftn.) | <i>Dorosoma cepedianum</i> (LeSueur, 1818) |
| †29. <i>Clupea nasus</i> Bl. 427 | <i>Nematalosa nasus</i> (Bloch, 1795) |
| or "Kome" Russ. 196 (ftn.) | |

LES ODONTOGNATHES (*GNATHOBOLUS* Schn.)

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| †30. "Odontognathe aiguillionné" Lac. | <i>Odontognathus mucronatus</i> Lac., 1800 |
|---------------------------------------|--|

LES PRISTIGASTRES (*PRISTIGASTER* Cuv.)

- *31. *Pristigaster tardoore* N., Russ. 193 *Opisthopterus tardoore* (Cuv., 1829)
 *32. *Pristigaster cayanus* N., Esp. nouv. *Pristigaster cayana* Cuv., 1829

[LES NOTOPTERES (*NOTOPTERUS*, Lacep.)]LES ANCHOIS (*ENGRAULIS* Cuv.)*†

- †33. *Clupea encrasicolus* L. Bl. 302 *Engraulis encrasicolus* (Lin., 1758)
 *34. *Engraulis meletta* N. Duham. *Engraulis encrasicolus* (Lin., 1758)
 *35. *Engraulis edentulus* N. Sloane *Cetengraulis edentulus* (Cuv., 1829)
 *36. *Engraulis lemniscatus* N. (ftn.) *Anchoa tricolor* (Agassiz, 1829)
 or *piquitinga* Margr. 159, Spix, 23 *Anchoa hepsetus* (Lin., 1758)
 †37. "Stolephore commersonien" Lacep. *Stolephorus commersonii* Lac., 1803
 or "Nattoo" Russ. 187, *Stolephorus indicus* (van Hass., 1823)
 prob. *Atherina australis* White (ftn.) *Engraulis australis* (White, 1790)
 38. "*Clupée tuberculose*" Lacep. (ftn.) *Thrissina baelama* (Forssk., 1775)
 †39. *Clupea atherinoides* Bl. (ftn.) *Pterengraulis atherinoides* (Lin., 1758)
 40. *Clupea telara* Buch. (ftn.) *Setipinna phasa* (Ham. Buch., 1822)
 41. *Clupea phasa* id. (ftn.) *Setipinna phasa* (Ham. Buch., 1822)
 42. "Poorwa" Russ. 194 (ftn.) *Thryssa*, either *T. hamiltonii* (Gray, 1835)
 or *T. malabarica* (Bloch, 1795)
 †43. *Clupea malabarica* Bl. 432 *Thryssa malabarica* (Bloch., 1795)

LES THRISSES (*THRISSA* Cuv. *MYSTUS* Lacep.)—1817
 and (*THRYSSA* Cuv.)—1829

- †44. *Clupea setirostris* Brouss. (ftn.) *Thryssa setirostris* (Brouss., 1782)
 †45. *Clupea mystus* L. (ftn.) *Coilia mystus* (Linnaeus, 1758)
 or "Pedda Poorawah" Russ. 190 (ftn.) *Thryssa purava* (Ham. Buch., 1822)
 †46. *Clupea mystax* Bl. Schn. 83 (ftn.) *Thryssa mystax* (Bloch & Schn., 1801)
 47. "Poorawah" Russ. 189 (ftn.) *Thryssa*, ? *T. mystax* (Bl. & Schn., 1801)

[LES MEGALOPS (*MEGALOPS* Lacep.)][LES ELOPS (*ELOPS* L.)][LES BUTIRINS (*BUTIRINUS* Commerson)][LES CHIROCENTRES (*CHIROCENTRUS* Cuv.)]

and seven further groups in the "Clupes"

TABLE 3.

List of all Clupeoid Fishes included by Valenciennes, with Identifications

* new genera and species

† species based solely on another description

Valenciennes name, author (page no.)	Modern name
Volume 20 (1847)	
<i>Clupea</i> Cuvier (p. 28)	<i>Clupea</i> Linnaeus, 1758
1. <i>C. harengus</i> Linné (p. 30)	<i>Clupea harengus</i> Lin., 1758
2. <i>C. leachii</i> Yarrell (p. 243)†	<i>Clupea harengus</i> Lin., 1758
3. <i>C. pontica</i> Eichw. (p. 244)	<i>Alosa kessleri pontica</i> (Eichwald, 1838)
4. <i>C. elongata</i> Les. (p. 247)	<i>Clupea harengus</i> Lin., 1758
*5. <i>C. pallasii</i> nob. (p. 253)	<i>Clupea harengus pallasii</i> Val., 1847
6. <i>C. lineolata</i> Pallas (p. 256)	<i>Clupea harengus</i> Lin., 1758
7. <i>C. virescens</i> DeKay (p. 257)†	? <i>Alosa pseudoharengus</i> (Wilson, 1811)
8. <i>C. parvula</i> Mitchill (p. 258)†	? juvenile <i>Alosa pseudoharengus</i> (Wilson, 1811)
9. <i>C. minima</i> Peck. (p. 259)†	<i>Clupea harengus</i> Lin., 1758
* <i>Sardinella</i> (p. 261)	<i>Sardinella</i> Valenciennes, 1847
*10. <i>S. aurita</i> nob. (p. 263)	<i>Sardinella aurita</i> Val., 1847
*11. <i>S. granigera</i> nob. (p. 267)	<i>Sardinella maderensis</i> (Lowe, 1836)
*12. <i>S. anchovia</i> nob. (p. 269)	<i>Sardinella aurita</i> Val., 1847
*13. <i>S. leiogaster</i> nob. (p. 270)	<i>Sardinella leiogaster</i> Val., 1847
*14. <i>S. lineolata</i> nob. (p. 272)	<i>Herklotsichthys punctatus</i> (Rüpp., 1837)
*15. <i>S. longiceps</i> nob. (p. 273)	<i>Sardinella longiceps</i> Val., 1847
*16. <i>S. neohowii</i> (p. 274)	<i>Sardinella aurita</i> Val., 1847
* <i>Harengula</i> (p. 277)	<i>Harengula</i> Valenciennes, 1847
*17. <i>H. latulus</i> nob. (p. 280)	<i>Harengula clupeola</i> (Cuvier, 1829)
18. <i>H. sprattus</i> nob. (p. 285)	<i>Sprattus sprattus</i> (Lin., 1758)
19. <i>H. clupeola</i> nob. (p. 289)	<i>Harengula clupeola</i> (Cuvier, 1829)
*20. <i>H. maculosa</i> nob. (p. 292)	<i>Harengula humeralis</i> (Cuvier, 1829)
*21. <i>H. abbreviata</i> nob. (p. 296)	<i>Sardinella</i> sp. (type lost, see p. 69)
22. <i>H. punctata</i> nob. (p. 297)	<i>Herklotsichthys punctatus</i> (Rüpp., 1837)
*23. <i>H. bipunctata</i> nob. (p. 298)†	<i>Herklotsichthys punctatus</i> (Rüpp., 1837)
*24. <i>H. arabica</i> nob. (p. 298)†	<i>Herklotsichthys punctatus</i> (Rüpp., 1837)
*25. <i>H. forsteri</i> nob. (p. 299)†	<i>Ethmalosa fimbriata</i> (Bowdich, 1825)
* <i>Pellona</i> (p. 300)	<i>Pellona</i> Valenciennes, 1847
*26. <i>P. orbignyana</i> nob. (p. 302)	<i>Pellona flavipinnis</i> (Valenciennes, 1837)
*27. <i>P. castelnaeana</i> nob. (p. 306)	<i>Pellona castelnaeana</i> Valenciennes, 1847
*28. <i>P. iserti</i> nob. (p. 307)†	<i>Ilisha africana</i> (Bloch, 1795)
29. <i>P. melastoma</i> nob. (p. 308)	<i>Ilisha megaloptera</i> (Swainson, 1839)
*30. <i>P. leschenaulti</i> nob. (p. 311)	<i>Ilisha elongata</i> (Bennett, 1830)
*31. <i>P. ditchoa</i> nob. (p. 313)†	<i>Ilisha indica</i> (Swainson, 1835)
*32. <i>P. ditchela</i> nob. (p. 314)†	<i>Pellona ditchela</i> Valenciennes, 1847
*33. <i>P. grayana</i> nob. (p. 315)†	<i>Ilisha elongata</i> (Bennett, 1830)
*34. <i>P. dussumieri</i> nob. (p. 316)	<i>Ilisha megaloptera</i> (Swainson, 1839)
*35. <i>P. vimbella</i> nob. (p. 317)	<i>Ilisha elongata</i> (Bennett, 1830)
*36. <i>P. novacula</i> nob. (p. 319)	<i>Ilisha elongata</i> (Bennett, 1830)
*37. <i>P. micropus</i> nob. (p. 320)	<i>Ilisha micropus</i> (Valenciennes, 1847)
*38. <i>P. filigera</i> nob. (p. 322)	<i>Ilisha filigera</i> (Valenciennes, 1847)
39. <i>P. motius</i> nob. (p. 323)	<i>Ilisha filigera</i> (Valenciennes, 1847)
40. <i>P. champil</i> nob. (p. 324)†	? <i>Hilsa</i> juvenile
41. <i>P. soborna</i> nob. (p. 325)†	<i>Corica soborna</i> Ham. Buch., 1822

Pristigaster Cuv. (p. 326)

- 42. *P. tartoor* nob. (p. 328)
- 43. *P. cayanus* nob. (p. 334)
- 44. *P. martii* Ag. (p. 337)
- *45. *P. phaeton* nob. (p. 338)

**Rogenia* Val. (p. 340)

- 46. *R. alba* nob. (p. 341)

**Clupeonia* Val. (p. 345)

- *47. *C. jussieui* nob. (p. 346)
- *48. *C. fasciata* nob. (p. 349)
- *49. *C. commersoni* nob. (p. 350)
- *50. *C. vittata* nob. (p. 352)
- *51. *C. blochii* nob. (p. 353)†

**Spratella* Val. (p. 356)

- *52. *S. pumila* nob. (p. 357)
- *53. *S. fimbriata* nob. (p. 359)

**Kowala* Val. (p. 362)

- *54. *K. albella* nob. (p. 362)
- *55. *K. thoracata* nob. (p. 363)

**Meletta* Val. (p. 366)

- *56. *M. vulgaris* nob. (p. 366)
- *57. *M. mediterranea* nob. (p. 369)
- *58. *M. senegalensis* nob. (p. 370)
- 59. *M. mallowaca* (Mitch.) (p. 371)
- *60. *M. venosa* nob. (p. 374)
- *61. *M. suoerii* nob. (p. 375)
- *62. *M. obtusirostris* nob. (p. 375)
- *63. *M. novae-hollandiae* nob. (p. 376)
- *64. *M. venenosa* nob. (p. 377)
- *65. *M. lile* nob. (p. 378)

**Alausa* Val. (p. 389)

- *66. *A. vulgaris* nob. (p. 391)
- *67. *A. eba* nob. (p. 417)
- *68. *A. dorsalis* nob. (p. 418)
- 69. *A. tyrannus* De Kay (p. 419)
- 70. *A. praestabilis* De Kay (p. 421)†
- 71. *A. teres* nob. (p. 423)
- 72. *A. menhaden* nob. (p. 424)
- 73. *A. shadina* nob. (p. 426)†
- 74. *A. aurea* Spix (p. 427)
- *75. *A. striata* nob. (p. 429)
- *76. *A. maculata* nob. (p. 430)
- *77. *A. coerulea* nob. (p. 432)
- 78. *A. palasah* nob. (p. 432)
- *79. *A. toli* nob. (p. 435)
- 80. *A. reevesii* Richardson (p. 437)†
- *81. *A. microlepis* nob. (p. 439)
- 82. *A. chapra* nob. (p. 440)†
- *83. *A. argyrochloris* nob. (p. 440)
- 84. *A. melanura* nob. (p. 441)
- 85. *A. melanosticta* Temm. et Schl. (p. 444)
- 86. *A. pilchardus* nob. (p. 445)

Pristigaster Cuvier, 1817

- Opisthopterus tardoore* Cuvier, 1829
- Pristigaster cayana* Cuvier, 1829
- Pristigaster cayana* Cuvier, 1829
- Pristigaster cayana* Cuvier, 1829

Clupea Linnaeus, 1758

- Clupea harengus* Linnaeus, 1758
- Sardinella* Valenciennes, 1847
- Sardinella jussieui* (Valenciennes, 1847)
- Herklotsichthys punctatus* (Rüppell, 1837)
- Sardinella melanura* (Cuvier, 1829)
- Sardinella melanura* (Cuvier, 1829)
- Hilsa kelee* (Cuvier, 1829)

Sprattus Girgensohn, 1846

- Sprattus sprattus* (Linnaeus, 1758)
- Sardinella fimbriata* (Valenciennes, 1847)
- Sardinella* Valenciennes, 1847
- Sardinella albella* (Valenciennes, 1847)
- Escualosa thoracata* (Valenciennes, 1847)

Sardinella Valenciennes, 1847

- Sprattus sprattus* (Linnaeus, 1758)
- Sardinella aurita* Valenciennes, 1847
- Ethmalosa fimbriata* (Bowdich, 1825)
- Alosa mediocris* (Mitchill, 1814)
- Alosa pseudoharengus* (Wilson, ca 1811)
- Alosa alabamiae* J. & E., 1896
- Herklotsichthys punctatus* (Rüppell, 1837)
- Sprattus novaehollandiae* (Valenciennes, 1847)
- Herklotsichthys punctatus* (Rüppell, 1837)
- Escualosa thoracata* (Valenciennes, 1847)

Alosa Linck, 1790

- Alosa alosa* (Linnaeus, 1758)
- Sardinella maderensis* (Lowe, 1839)
- Ethmalosa fimbriata* (Bowdich, 1825)
- Brevoortia tyrannus* (Latrobe, 1802)
- Alosa sapidissima* (Wilson, ca 1811)
- Etrumeus teres* (DeKay, 1842)
- Brevoortia tyrannus* (Latrobe, 1802)
- (On *Clupea sadina* Mitch. = *nomen dubium*)
- Brevoortia aurea* (Agassiz, 1829)
- Opisthonema oglinum* (Le Sueur, 1817)
- Ethmidium maculatum* (Valenciennes, 1847)
- Ethmidium maculatum* (Valenciennes, 1847)
- (mixed, mainly *Hilsa ilisha*—see p. 92)
- Hilsa (Tenualos) toli* (Valenciennes, 1847)
- Hilsa (Tenualos) reevesii* (Richardson, 1846)
- Gudusia chapra* (Ham. Buch., 1822)
- Gudusia chapra* (Ham. Buch., 1822)
- Hilsa (Tenualos) toli* (Valenciennes, 1847)
- Sardinella melanura* (Cuvier, 1829)
- Sardinops melanostictus* (Temm. & Schl., 1846)
- Sardina pilchardus* (Walbaum, 1792)

Addenda to Volume 20 (no specimens)

87. *Clupanodon motius* Buch.†
88. *Clupea fuegensis* Jenn.†
89. *Clupea arcuata* Jenn.†
90. *Clupea sagax* Jenn.†
91. *Clupea isingleena* Rich.†
92. *Clupea nymphaea* Rich.†
93. *Clupea caeruleo-vittata* Rich.†
94. *Clupea flos-maris* Rich.†
95. *Clupea gracilis* Temm. et. Schl.†

- Ilisha motius* (Ham. Buch., 1822)
Sprattus fuegensis (Jenyns, 1842)
Ramnogaster arcuata (Jenyns, 1842)
Sardinops sagax (Jenyns, 1842)
Sardinella fimbriata (Valenciennes, 1847)
Sardinella aurita Valenciennes, 1847
Sardinella aurita Valenciennes, 1847
Dussumieria acuta Valenciennes, 1847
Spratelloides gracilis (Temm. & Schl., 1846)

Supplement to Volume 19

Dussumieria Val. (p. 467)

Dussumieria Valenciennes, 1847

*96. *D. acuta* nob. (p. 467)

Dussumieria acuta Valenciennes, 1847

Volume 21 (1848)

Engraulis Cuv. (p. 2)

Engraulis Cuvier, 1817

97. *E. encrasicolus* Linne (p. 7)
98. *E. ringens* Jen.† (p. 27)
99. *E. japonicus* Temm. et. Schl.† (p. 28)
- *100. *E. dentex* nob. (p. 28)
101. *E. atherinoides* nob. (p. 31)
102. *E. baelama* nob. (p. 35)
- *103. *E. spinifer* nob. (p. 39)
104. *E. brownii* nob. (p. 41)
- *105. *E. argyrophanus* K. et H. (p. 49)
- *106. *E. mitchilli* nob. (p. 50)
- *107. *E. edentulus* Cuv. (p. 51)
- *108. *E. brevifilis* nob. (p. 54)
109. *E. telara* nob. (p. 56)
110. *E. phasa* nob.† (p. 59)
- *111. *E. taty* nob. (p. 60)
- *112. *E. tenuifilis* nob. (p. 62)
113. *E. malabaricus* nob.
114. *E. purava* nob. (p. 65)
115. *E. hamiltoni* nob. (p. 66)
116. *E. mystax* nob.† (p. 67)
- *117. *E. dussumieri* nob. (p. 69)
118. *E. setirostris* nob.† (p. 69)
119. *E. mystus* nob. † (p. 73)

- Engraulis encrasicolus* (Linnaeus, 1758)
Engraulis ringens (Jenyns, 1842)
Engraulis japonicus Temm. & Schl., 1846
Lycengraulis grossidens (Agassiz, 1829)
Pterengraulis atherinoides (Linnaeus, 1758)
Thrissina baelama (Forsskål, 1775)
Anchoa spinifer (Valenciennes, 1848)
Composite: *Anchoa* + *Stolephorus*
Engraulis encrasicolus (Linnaeus, 1758)
Anchoa mitchilli (Valenciennes, 1848)
Cetengraulis edentulus (Cuvier, 1829)
(*Setipinna* Swainson)
Setipinna phasa (Ham. Buch., 1822)
Setipinna phasa (Ham. Buch., 1822)
Setipinna phasa (Ham. Buch., 1822)
Setipinna taty (Valenciennes, 1848)
Setipinna taty (Valenciennes, 1848)
(*Thryssa* Cuvier)
Thryssa malabarica (Bloch, 1795)
Thryssa purava (Ham. Buch., 1822)
Thryssa hamiltonii (Gray, 1835)
Thryssa mystax (Bloch & Schneider, 1801)
Thryssa dussumieri (Valenciennes, 1848)
Thryssa setirostris (Broussonet, 1782)
Coilia mystus (Linnaeus, 1758)

Coilia (p. 77)

Coilia Gray, 1830

120. *C. hamiltoni* nob. (p. 79)
- *121. *C. reynaldi* nob. (p. 81)
- *122. *C. dussumieri* nob. (p. 81)
- *123. *C. quadragesimalis* nob. (p. 83)
124. *C. grayi* Richards.† (p. 84)
125. *C. playfairii* Rich.† (p. 86)

- Coilia ramcarati* (Ham. Buch., 1822)
Coilia reynaldi Valenciennes, 1848
Coilia dussumieri Valenciennes, 1848
Coilia ramcarati (Ham. Buch., 1822)
Coilia mystus (Linnaeus, 1758)
Coilia playfairii Richardson, 1846

Odontognathus Lac.

Odontognathus Lacepède, 1801

126. *Gnathobolus mucronatus* Schn. (p. 91)

Odontognathus mucronatus Lacepède, 1801

Chatoessus Cuv.

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| 127. <i>C. cepedianus</i> nob. (p. 99) | <i>Dorosoma Rafinesque</i> , 1820 |
| 128. <i>C. nasus</i> nob. (p. 104) | <i>Dorosoma cepedianum</i> (Le Sueur, 1818) |
| *129. <i>C. osbeckii</i> nob. (p. 196) | <i>Nematalosa nasus</i> (Bloch, 1795) |
| 130. <i>C. punctatus</i> Temm. et Schl.† (p. 107) | <i>Clupanodon thrissa</i> (Linnaeus, 1758) |
| 131. <i>C. maculatus</i> Gray† (p. 108) | <i>Konosirus punctatus</i> (Temm. & Schl., 1846) |
| 132. <i>C. aquosus</i> Richards.† (p. 109) | <i>Clupanodon thrissa</i> (Linnaeus, 1758) |
| 133. <i>C. chrysopterus</i> Richards.† (p. 110) | <i>Konosirus punctatus</i> (Temm. & Schl., 1846) |
| 134. <i>C. chacunda</i> nob. (p. 111) | ? <i>Nematalosa nasus</i> (Bloch, 1795) |
| 135. <i>C. manmina</i> nob. † (p. 114) | <i>Anodontostoma chacunda</i> (Ham. Buch., 1822) |
| 136. <i>C. cortius</i> nob.† (p. 115) | <i>Gonialosa manmina</i> (Ham. Buch., 1822) |
| 137. <i>C. chanpole</i> nob.† (p. 116) | <i>Gonialosa manmina</i> (Ham. Buch., 1822) |
| *138. <i>C. tampo</i> nob.† (p. 117) | <i>Anodontostoma chanpole</i> (Ham. Buch., 1822) |
| | <i>Hilsa</i> sp. (see text, p. 94) |

TABLE 4

List of Lacepède, Cuvier and Valenciennes Clupeoid Genera and Species

	modern name
<i>Dussumieria</i> Val.	<i>Dussumieria</i> Valenciennes, 1847
1. <i>Dussumieria acuta</i> Val.	<i>Dussumieria acuta</i> Valenciennes, 1847
2. <i>Elops javanicus</i> Val.	<i>nomen nudum</i>
3. <i>Clupea pallasii</i> Val.	<i>Clupea harengus pallasii</i> Valenciennes, 1847
<i>Rogenia</i> Val.	<i>Clupea</i> Linnaeus, 1758
4. (<i>Rogenia alba</i>)	<i>Clupea harengus</i> Linnaeus, 1758
<i>Spratella</i> Val.	<i>Spratrus</i> Girgensohn, 1846
5. <i>Spratella pumila</i> Val.	<i>Spratrus sprattus</i> (Linnaeus, 1758)
6. <i>Clupea latulus</i> Cuv.	<i>Spratrus sprattus</i> (Linnaeus, 1758)
<i>Meletta</i> Val.	<i>Spratrus</i> Girgensohn, 1846
7. <i>Meletta vulgaris</i> Val.	<i>Spratrus sprattus</i> (Linnaeus, 1758)
8. <i>Meletta novae-hollandiae</i> Val.	<i>Spratrus novaehollandiae</i> (Valenciennes, 1847)

- Harengula* Val.
9. *Clupea clupeiola* Cuv.
10. *Harengula latulus* Val.
11. *Clupea humeralis* Cuv.
12. *Harengula maculosa* Val.
(*Harengula humeralis* of Val.)
13. *Sardinella lineolata* Val.
14. *Harengula bipunctata* Val.
15. *Harengula arabica* Val.
16. *Clupeonia fasciata* Val.
17. *Meletta obtusirostris* Val.
18. *Meletta venenosa* Val.
Sardinella Val.
19. *Sardinella aurita* Val.
20. *Meletta mediterranea* Val.
21. *Sardinella anchovia* Val.
22. *Sardinella longiceps* Val.
23. *Sardinella neohowii* Val.
24. *Alausa scombrina* Val.
25. *Sardinella granigera* Val.
26. *Alausa eba* Val.
27. *Spratella fimbriata* Val.
Kowala Val.
28. *Kowala albella* Val.
29. *Clupanodon jussieu* Lac.
30. *Clupeonia jussieu* Val.
31. *Clupea melanura* Cuv.
32. *Clupeonia commersonii* Val.
33. *Clupea otaitensis* Val.
34. *Clupeonia vittata* Val.
35. *Sardinella leiogaster* Val.
36. *Harengula abbreviata* Val.
37. *Clupea coval* Cuv.
38. *Kowala thoracata* Val.
39. *Meletta lile* Val.
40. (*Meletta thrissa* of Val.)
41. *Alausa striata* Val.
Alausa Val.
42. *Alausa vulgaris* Val.
43. *Clupea fallax* Lac.
44. *Clupea rufa* Lac.
45. *Clupea finta* Cuv.
46. *Meletta venosa* Val.
47. *Meletta suoerii* Val.
48. *Harengula forsteri* Val.
49. *Meletta senegalensis* Val.
50. *Alausa dorsalis* Val.
51. *Alausa maculata* Val.
52. *Alausa coerulea* Val.
53. *Clupea kelee* Cuv.
54. *Clupeonia blochii* Val.
55. *Clupea palasah* Cuv.
56. *Alausa toli* Val.
- Harengula Valenciennes*, 1847
- Harengula clupeiola* (Cuvier, 1829)
- Harengula clupeiola* (Cuvier, 1829)
- Harengula humeralis* (Cuvier, 1829)
- Harengula humeralis* (Cuvier, 1829)
- Harengula pensacolae* Goode & Bean, 1879
- Herklotsichthys punctatus* (Rüppell, 1837)
- Herklotsichthys punctatus* (Rüppell, 1837)
- Harklotsichthys punctatus* (Rüppell, 1837)
- Herklotsichthys punctatus* (Rüppell, 1837)
- Herklotsichthys punctatus* (Rüppell, 1837)
- Herklotsichthys punctatus* (Rüppell, 1837)
- Sardinella Valenciennes*, 1847
- Sardinella aurita* Valenciennes, 1847
- Sardinella aurita* Valenciennes, 1847
- Sardinella aurita* Valenciennes, 1847
- Sardinella longiceps* Valenciennes, 1847
- Sardinella longiceps* Valenciennes, 1847
- Sardinella longiceps* Valenciennes, 1847
- Sardinella maderensis* (Lowe, 1839)
- Sardinella maderensis* (Lowe, 1839)
- Sardinella fimbriata* (Valenciennes, 1847)
- Sardinella Valenciennes*, 1847
- Sardinella albella* (Valenciennes, 1847)
- nomen dubium*
- Sardinella jussieu* (Valenciennes, 1847)
- Sardinella melanura* (Cuvier, 1829)
- Sardinella melanura* (Cuvier, 1829)
- nomen nudum*
- Sardinella melanura* (Cuvier, 1829)
- Sardinella leiogaster* Valenciennes, 1847
- nomen dubium*
- nomen dubium*
- Escualosa thoracata* (Valenciennes, 1847)
- Escualosa thoracata* (Valenciennes, 1847)
- Opisthonema oglinum* (LeSueur, 1817)
- Opisthonema oglinum* (LeSueur, 1817)
- Alosa* Linck, 1790
- Alosa alosa* (Linnaeus, 1758)
- Alosa fallax* (Lacepède, 1803)
- Alosa fallax* (Lacepède, 1803)
- Alosa fallax* (Lacepède, 1803)
- Alosa pseudoharengus* (Wilson, ca 1811)
- Alosa alabamæ* Jord. & Ever., 1896
- Ethmalosa fimbriata* (Bowdich, 1825)
- Ethmalosa fimbriata* (Bowdich, 1825)
- Ethmalosa fimbriata* (Bowdich, 1825)
- Ethmidium maculatum* (Valenciennes, 1847)
- Ethmidium maculatum* (Valenciennes, 1847)
- Hilsa kelee* (Cuvier, 1829)
- Hilsa kelee* (Cuvier, 1829)
- Hilsa (Tenualos) ilisha* (Ham. Buch., 1822)
- Hilsa (Tenualos) toli* (Valenciennes, 1847)

57. *Alausa argyrochloris* Val.
 58. *Chatoessus tampo* Val.
 59. *Alausa microlepis* Val.
Chatoessus Cuv.
 60. *Megalops bimaculata* Val.
Clupanodon Lac.
 61. *Chatoessus osbecki* Val.
Pristigaster Cuv.
 62. *Pristigaster cayanus* Cuv.
 63. *Pristigaster phaeton* Val.
Odontognathus Lac.
 64. *Odontognathus mucronatus* Lac.
Pellona Val.
 65. *Pristigaster flavipinnis* Val.
 66. *Pellona orbignyana* Val.
 67. *Pellona castelnaeana* Val.
 68. *Pellona ditchela* Val.
 69. *Pellona iserti* Val.
 70. *Pellona dussumieri* Val.
 71. *Pellona micropus* Val.
 72. *Pellona ditchoa* Val.
 73. *Pellona filigera* Val.
 74. *Pellona leschenaulti* Val.
 75. *Pellona grayana* Val.
 76. *Pellona vimbella* Val.
 77. *Pellona novacula* Val.
 78. *Pristigaster tardoore* Cuv.
Engraulis Cuv.
 79. *Engraulis argyrophanus* Val.
 80. *Engraulis meletta* Cuv.
 81. *Engraulis mitchilli* Val.
 82. *Engraulis louisiana* Val.
 83. *Engraulis spinifer* Val.
 84. *Engraulis lemniscatus* Cuv.
 85. *Engraulis edentulus* Cuv.
 86. *Engraulis dentex* Val.
Stolephorus Lac.
 87. *Stolephorus commersonii* Lac.
 88. *Clupea vittargentea* Lac.
 89. *Clupea tuberculosa* Lac.
Thryssa Cuv.
 90. *Engraulis dussumieri* Val.
 91. *Clupea chrysoptera* Lac.
Telara Val.
 92. *Engraulis brevifilis* Val.
 93. *Engraulis taty* Val.
 94. *Engraulis tenuifilis* Val.
Mystus Lac.
 95. *Mystus clupeoides* Lac.
 96. *Coilia reynaldi* Val.
 97. *Coilia dussumieri* Val.
 98. *Coilia quadragesimalis* Val.
- Hilsa* (*Tenuulosa*) *toli* (Valenciennes, 1847)
 - ? *Hilsa* sp.
 - Gudusia chapra* (Ham. Buch., 1822)
 - Dorosoma* Rafinesque, 1820
nomen nudum
 - Clupanodon* Lacepède, 1803
 - Clupanodon thrissa* (Linnaeus, 1758)
 - Pristigaster* Cuvier, 1817
 - Pristigaster cayana* Cuvier, 1829
 - Pristigaster cayana* Cuvier, 1829
 - Odontognathus* Lacepède, 1800
 - Odontognathus mucronatus* Lacepède, 1800
 - Pellona* Valenciennes, 1847
 - Pellona flavipinnis* (Valenciennes, 1837)
 - Pellona flavipinnis* (Valenciennes, 1837)
 - Pellona castelnaeana* Valenciennes, 1847
 - Pellona ditchela* Valenciennes, 1847
 - Ilisha africana* (Bloch, 1795)
 - Ilisha megaloptera* (Swainson, 1839)
 - Ilisha micropus* (Valenciennes, 1847)
 - Ilisha indica* (Swainson, 1839)
 - Ilisha filigera* (Valenciennes, 1847)
 - Ilisha elongata* (Bennett, 1830)
 - Ilisha elongata* (Bennett, 1830)
 - Ilisha elongata* (Bennett, 1830)
 - Ilisha elongata* (Bennett, 1830)
 - Opisthopterus tardoore* (Cuvier, 1829)
 - Engraulis* Cuvier, 1817
 - Engraulis encrasicolus* (Linnaeus, 1758)
 - Engraulis encrasicolus* (Linnaeus, 1758)
 - Anchoa mitchilli* (Valenciennes, 1848)
nomen nudum
 - Anchoa spinifer* (Valenciennes, 1848)
 - Anchoa tricolor* (Agassiz, 1829)
 - Cetengraulis edentulus* (Cuvier, 1829)
 - Lycengraulis grossidens* (Agassiz, 1829)
 - Stolephorus* Lacepède, 1803
 - Stolephorus commersonii* Lacepède, 1803
 - Stolephorus* or *Engraulis* sp.
 - Thrissina baelama* (Forsskal, 1775)
 - Thryssa* Cuvier, 1829
 - Thryssa dussumieri* (Valenciennes, 1848)
 - ? *Thryssa* sp.
 - Setipinna* Swainson, 1839
 - Setipinna phasa* (Ham. Buch., 1822)
 - Setipinna taty* (Valenciennes, 1848)
 - Setipinna taty* (Valenciennes, 1848)
 - Coilia* Gray, 1831
 - Coilia mystus* (Linnaeus, 1758)
 - Coilia reynaldi* Valenciennes, 1848
 - Coilia dussumieri* Valenciennes, 1848
 - Coilia ramcarati* (Ham. Buch., 1822)

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INDEX

(Senior synonyms in **bold face italic**)

- abbreviata*, *Harengula*, 12, 69
abnormis, *Ilisha*, 111, 119
acuta, *Dussumieria*, 13, 101, pl. 1a
aestivalis, *Pomolobus*, 83
affinis, *Clupea*, 119, pl. 8c
africana, *Clupea*, 8, 112
Ilisha, 86, 112
africanus, *Clupanodon*, 112
alabamae, *Alosa*, 11, 84
Alaccie, 39
Alachie, 82
Alausa, 77
argyrochloris, 60, 61, 93
coerulea, 88, 89
dorsalis, 84, 85, 86
eba, 49
maculata, 87, 88
melanura, 37, 66
microlepis, 95
palasah, 91
scombrina, 46
striata, 75
toli, 93
vulgaris, 77, 78
alba, *Clupea*, 17
Rogenia, 17, pl. 1d
albella, *Kowala*, 52, 53, pl. 4c
Sardinella, 53, 59, 70, 72, pl. 4c
Albula vulpes, 85
Allecia, 39
allecia, *Clupea*, 11, 37, 39
Alosa, 77
alabamae, 11, 84
alosa, 78
chrysochloris, 84
elongata, 111, 118-120, 123
fallax, 79, 81, 82
fallax fallax, 79
fallax var. lacustris, 79
fallax nilotica, 81
ficta, 81
finta, 81
platycephalus, 85
pseudoharengus, 82, 84
sapidissima, 84
senegalensis, 11, 86
alosa, *Alosa*, 78
Clupea, 77, 79
Alose, 82
ALOSINAE, 76
altus, *Mystus*, 75
amazonica, *Ilisha*, 105
Amblygaster clupeoides, 69
amblyropterus, *Ilisha*, 114
americanus, *Pristigaster*, 102
Anchoa, 127
argentivittata, 127
mitchilli diaphana, 129
duodecim, 127
hepsetus, 129, 131
lyolepis, 127
mitchilli, 127
mitchilli mitchilli, 128
spinifer, 129, 134
tricolor, 131, pl. 10a
Anchois, 124
anchoita, *Engraulis*, 132
Anchovia pallida, 133
potiana, 133
anchovia, *Sardinella*, 42
Anchoviella eurystole, 127, 129
guineensis, 126
perfasciata, 127
spinifera, 131
Anodontostoma chacunda, 95
chanpole, 95
ansorgii, *Cynothrissa*, 101
antipodum, *Sprattus*, 22
Apterygia hamiltoni, 123
ramcarata, 123
arabica, *Harengula*, 33
arcuata, *Clupea*, 76
argenteus, *Esox*, 85
argentivittatus, *Anchoa*, 127
argyrochloris, *Alausa*, 60, 61, 93
argyrophanus, *Engraulis*, 125, 127
argyrotaenia, *Clupea* (*Leptogaster*), 70
Spratelloides, 136
Atherina australis, 129
brownii, 129
japonica, 12, 135, 136
menidia, 129

- atricauda*, *Clupea*, 63
aurita, *Sardinella*, 11, 36, 37-43, pl. 1b
aurovittata, *Clupea*, 11, 37, 40
australis, *Atherina*, 129
Engraulis, 126
baelama, *Clupea*, 140
Thrissina, 140
bassensis, *Clupea*, 21
Clupea (*Pomolobus*), 21
Sprattus, 22
bataviensis, *Stolephorus*, 138
Bellonii, *Trichis*, 77
bimaculata, *Megalops*, 11, 97
bipunctata, *Clupea*, 32
Harengula, 32
Blanquette, 19, 23
blockii, *Clupeonia*, 91
Boelama, 141
borneensis, *Coilia*, 152
brachysoma, *Ilisha*, 114, 116, 117
Pellona, 115
Sardinella, 54, 59
branisai, *Gasteroclupea*, 101
brasiliensis, *Sardinella*, 42, 43
Breitling, 19, 23
brevifilis, *Engraulis*, 145, 148
brownii, *Atherina*, 129
Engraulis, 129
buccaneeri, *Stolephorus*, 139
bulan, *Clupalosa*, 53
Sardinella, 70
caerulea, *Clupea*, 129
caeruleovittata, *Clupea*, 11, 37, 40
Cailleu, 24, 25
Cailleu-tassard des Antilles, 96
cameronensis, *Sardinella*, 48, 86
capensis, *Engraulis*, 126, 139
castelnaeana, *Pellona*, 106, 107, 108
cayana, *Pristigaster*, 11, 100, 101, 102,
 pl. 6c
cayanus, *Pristigaster*, 8, 100
cepediana, *Megalops*, 96
cepedianum, *Dorosoma*, 97
cepedianus, *Chatoessus*, 97
Cetengraulis, 132
edentulus, 132, pl. 11a
mysticetus, 132
chacunda, *Anodontostoma*, 95
chanpole, *Anodontostoma*, 95
chapra, *Clupanodon*, 95
Gudusia, 95
Chatoessus, 8, 96
cepedianus, 97
osbecki, 98
tampo, 12, 94
chilcae, *Ethmidium*, 88
chinensis, *Clupea*, 91
chinois, *Clupanodon*, 56, 57, 61, 63, 64, pl. 3b
Chirocentrus nudus, 11, 115
russellii, 11, 115
chrysochloris, *Alosa*, 84
Pomolobus, 84
chrysoptera, *Clupea*, 7, 12, 145
chrysostigma, *Leptonurus*, 155
cleithral pocket, 146, fig. 14a
Clupalosa bulan, 53
Clupanodon, 98
africanus, 112
chapra, 95
chinois, 56, 57, 61, 63, 64, pl. 3b
ilisha, 91
jussieu, 7, 12, 37, 54, 58, 63, 98, pl. 3c, d
motius, 12, 115
sinensis, 57, 63
thrissa, 75, 96
thryssa, 98
Clupea, 15
affinis, 119, pl. 8c
africana, 8, 112
alba, 17
allecia, 11, 37, 39
alosa, 77, 79
arcuata, 76
(Leptogaster) argyrotaenia, 70
atricauda, 63
aurovittata, 11, 37, 39
baelama, 140
bassensis, 21
(Pomolobus) bassensis, 21
bipunctata, 32
caerulea, 129
caeruleovittata, 11, 37, 40
chinensis, 91
chrysoptera, 7, 12, 145
clupeola, 22, 24
coval, 12, 70, pl. 5a
cyprinoides, 6
dorab, 6
encrasicolus, 124, 149
fallax, 7, 79
fasciata, 6, 7, 16
ficta, 12
finta, 82

- fimbriata*, 84, 85, pl. 5b
gibbosa, 56
harengus, 17, 19, 101
harengus pallasii, 16
humeralis, 27
kelee, 90, pl. 6a
kowal, 72
latulus, 19
macrocephala, 6
macrolepis, 70
maderensis, 47, 85
malabarica, 8
melanura, 62
melastoma, 11, 105, 110, 111
micropus, 13
mystax, 141
mystus, 12, 141, 142, 148, 149
nasus, 97
notacanthus, 88
 (Alosa) *notacanthoides*, 87, 88
nymphaea, 40
otaitensis, 11, 37, 65
palasah, 91
pallasii, 16
phasa, 145
pseudoharengus, 82
punctata, 31
rufa, 81
schoneveldii, 20
 (Harengula) *schrammi*, 20
setipinna, 85
setirostris, 85, 140
setosa, 85, 88
sima, 120
sinensis, 8, 12, 57, 63, 91, pl. 6b
telara, 145
thrissa, 73, 75, 96, 98, 141
triza, 75
tropica, 6, 16, 113, 156
tuberculosa, 7, 140, pl. 9c
venosa, 35
vittargentea, 7, 12, 136, 139
vittata, 66, 129
CLUPEIDAE, 15
CLUPEINAE, 15
clupeoides, *Amblygaster*, 69
Coilia, 101, 149
Mystus, 141, 148, 149
Sardinella, 69
clupeola, *Clupea*, 22, 24
Harengula, 24, 26, pl. 1c, pl. 2c
Clupeonia, 58
blochii, 91
commersoni, 37, 64
fasciata, 33, 58
jussieui, 34, 37, 58, 59, pl. 4a
vittata, 37, 62, 66
coerulea, *Alausa*, 88, 89
Coilia, 12, 148
borneensis, 152
clupeoides, 101, 149
dussumieri, 154, pl. 11c
grayii, 149, 150
hamiltonii, 148, 152
lindmani, 150
macrognathos, 150
mystus, 142, 148, 149, pl. 11b
playfairii, 149
quadragesimalis, 149, 152
ramcarati, 149, 152
reynaldi, 149, 150
come, *Nematalosa*, 96
commersoni, *Clupeonia*, 37, 64
commersonii, *Stolephorus*, 7, 135, 136,
 137-139, pl. 9c,d
compressus, *Engraulis*, 127
Odontognathus, 104
coval, *Clupea*, 12, 70, pl. 5a
Cynothrissa ansorgii, 101
cyprinoides, *Clupea*, 6
Megalops, 85

dayi, *Sardinella*, 56, 59, 60
 De Latulo, 19
Demicoilia, 149, 153
margaritifera, 153, 155
dentatus, *Engraulis*, 131
dentex, *Engraulis*, 134
desmaresti, *Engraulis*, 12, 40
diaphana, *Anchoa mitchilli*, 129
Diplomystus, 87
dispilonotus, *Harengula*, 31
ditchela, *Neosteus*, 111
Pellona, 105, 110, 115, 116, pl. 7b
Ditchelee, 110, 115, pl. 7b
ditchoa, *Pellona*, 116, pl. 8b
Ditchoee, 116, pl. 8b
dolloi, *Pristigaster*, 112
dorab, *Clupea*, 6
Dorosoma, 75, 96
cepedianum, 97
notata, 96
DOROSOMATINAE, 96
dorsalis, *Alausa*, 84, 85, 86
dovii, *Opisthopterus*, 122

duodecim, Anchoa, 127

durbanensis, Paralosa, 90

dussumieri, Coilia, 154, pl. 11c

Engraulis, 142

Pellona, 113, pl. 7c

Thryssa, 142

Dussumieria, 13

acuta, 13, 101, pl. 1a

elopsoides, 15

hasseltii, 14

productissima, 14

DUSSUMIERIIDAE, 13

eba, Alausa, 49

Sardinella, 48

edentulus, Cetengraulis, 132, pl. 11a

Engraulis, 132

effulgens, Opisthopterus, 122

Ekan-Tampo, 94

elongata, Alosa, 111, 118–120, 123

Ilisha, 114, 118–121, pl. 8c

Pristogaster, 115, 122

Elops hawaiiensis, 85

javanicus, 11, 15, 69

elopsoides, Dussumieria, 15

Encrasicholus, 7, 12, 124, 136

encrasicholus, 124

encrasicholus, Clupea, 124, 149

Encrasicholus, 124

Engraulis, 125, 127, pl. 9b

ENGRAULIDAE, 124

Engraulis, 8, 12, 124

anchoita, 132

argyrophanus, 125, 127

australis, 126

brevifilis, 145, 148

brownii, 129

capensis, 126, 139

compressus, 127

dentatus, 131

dentex, 134

desmaresti, 12, 40

dussumieri, 142

edentulus, 132

encrasicholus, 125, 127, pl. 9b

grossidens, 12, 131, 134

janeiro, 134

japonicus, 126

juruensis, 132

lemniscatus, 131, pl. 10a

louisiana, 11, 129

malabaricus, 161, pl. 10b

meletta, 127, pl. 9b

mitschilli, 127

mordax, 132

mystus, 149

piquitinga, 131

ringens, 132

spinifer, 129

taty, 146

tenuifilis, 147

tricolor, 131

ensiformis, Mystus, 148, 149, pl. 11b

Escualosa, 70

thoracata, 17, 70, 71–72

Esox argenteus, 85

hepsetus, 129, 131

Esprot, 23

Ethmalosa, 84

fimbriata, 85, 86, pl. 5b

Ethmidium, 87

chilcae, 88

maculatum, 88, 89

Etrumeus teres, 13

eurystole, Anchoviella, 127, 129

fallax, Alosa, 79, 81, 82

Alosa fallax, 79

Clupea, 7, 79

fasciata, Clupea, 6, 7, 16

Clupeonia, 33, 58

Feinte, 81

festucosus, Halex, 75, pl. 5c

ficta, Alosa, 81

Clupea, 12

filigera, Ilisha, 114, 117

Pellona, 117

fimbriata, Clupea, 84, 85, pl. 5b

Ethmalosa, 85, 86, pl. 5b

Harengula, 85

Sardinella, 50, 59, 60, pl. 4b

Spratella, 50, 61, pl. 4b

finta, Alosa, 81

Clupea, 82

flavipinnis, Pellona, 106, 107, 110, pl. 7a

Pristigaster, 106, pl. 7a

forsteri, Harengula, 85

fuegensis, Sprattus, 22

gabonica, Pellona, 112

Gasteroclupea branisai, 101

gibbosa, Clupea, 56

Sardinella, 32, 34, 37, 51, 58, 59

- Gnathobolus*, 103, 104
mucronatus, 104, pl. 7d
Gonialosa, 98
gracilis, *Spratelloides*, 136
 (Grande) Sardine de l'Île de France, 54, 61,
 63, pl. 3a
granigera, *Sardinella*, 47, 48
grayana, *Pellona*, 119
grayii, *Coilia*, 149, 150
grossidens, *Engraulis*, 12, 131, 134
Lycengraulis, 134
Gudusia chapra, 95
variegata, 96
guineensis, *Anchoviella*, 126
- haleciformis*, *Sprattus*, 18
Halex, 7, 12
festucosus, 75, pl. 5c
hamiltoni, *Apterygia*, 123
hamiltonii, *Coilia*, 148, 152
Thrissa, 123, 140
Thryssa, 158, pl. 10c
 Harenguet, 23
Harengula, 22, 105
abbreviata, 12, 69
arabica, 33
bipunctata, 32
clupeola, 24, 26, pl. 1c, pl. 2c
dispilonotus, 31
fimbriata, 85
forsteri, 85
humeralis, 27, 28, 29, pl. 2d
latulus, 22, 26, pl. 1c
macrophthalmia, 76
maculosa, 28
majorina, 29
ovalis, 94
pensacolae, 29
pensacolae majorina, 30
spilura, 105
thrissina, 89
vittata, 37, 62
 Harengule Blanquette, 22
harengus, *Clupea*, 17, 19, 101
Harengus minor, 133, pl. 11a
hasseltii, *Dussumieria*, 14
hawaiiensis, *Elops*, 85
hepsetus, *Anchoa*, 129, 131
Esox, 129, 131
Herklotsichthys, 31, 105
punctatus, 31–36, 58, 62, 94
vittatus, 63
- Hilsa**, 90
ilisha, 57
 (Tenuulosa) *ilisha*, 91
kelee, 56, 70, 90, 91, pl. 6a, b
macrura, 95
toli, 90, 91
 (Tenuulosa) *toli*, 93
hoevenii, *Pellona*, 111
humeralis, *Clupea*, 27
Harengula, 27, 28, 29, pl. 2d
Sardinella, 76
Hyperlophus, 22, 87
- Ilisha**, 105, 111
abnormis, 111, 119
africana, 86, 112
amazonica, 105
amblyuropterus, 114
brachysoma, 114, 116, 117
elongata, 114, 118–121, pl. 8c
filigera, 114, 117
indica, 11, 116, pl. 8b
kampeni, 114
leschenaulti, 114
macrogaster, 114
megaloptera, 11, 111, 113, 116, pl. 7c,
 pl. 8a
melanota, 112
micropus, 115
motius, 114, 115
novacula, 114
pristigastroides, 114
sladeni, 114
xanthoptera, 114, 118
ilisha, *Clupanodon*, 91
Hilsa, 57
Hilsa (Tenuulosa), 91
indica, *Ilisha*, 11, 116, pl. 8b
indicus, *Platygaster*, 115, 116
Pristogaster, 115, 122
Stolephorus, 138, 139
insularis, *Stolephorus*, 138
iserti, *Pellona*, 112
- Jangarloo, 111, 113–115, pl. 8a
janeiro, *Engraulis*, 134
japonica, *Atherina*, 12, 135, 136
japonicus, *Engraulis*, 126
Stolephorus, 135
javanicus, *Elops*, 11, 15, 69
juruenis, *Engraulis*, 132

jussieu, *Clupanodon*, 7, 12, 37, **54**, 58, 63, 98

Sardinella, **61**

jussieu, *Clupeonia*, 34, 37, 58, **59**, pl. 4a

Sardinella, **59**, 94

kampeni, *Ilisha*, **114**

Keelee, **90**, pl. 6a

kelee, *Clupea*, **90**, pl. 6a

Hilsa, 56, 70, **90**, **91**, pl. 6a, b

Knightia, **87**

Kome, **97**

Kowal, **70**, 72, pl. 5a

kowal, *Clupea*, **72**

Kowala, **52**, 70

albella, 52, **53**, pl. 4c

thoracata, 52, 70, **71**

Kowarloo, **72**

lacustris, *Alosa fallax* var., **79**

latulus, *Clupea*, **19**

Harengula, 22, **26**, pl. 1c

leiogaster, *Sardinella*, 40, **68**

lemniscatus, *Engraulis*, **131**, pl. 10a

Leptogaster, **70**

Leptonurus, **149**

chrysostigma, **155**

leschenaulti, *Ilisha*, **114**

Pellona, **118**

Lile stolifera, **89**

lile, *Meletta*, **72**

lineolata, *Sardinella*, **31**

lindmani, *Coilia*, **150**

longiceps, *Sardinella*, **44-46**

louisiana, *Engraulis*, 11, **129**

Lycengraulis, **134**

grossidens, **134**

lyolepis, *Anchoa*, **127**

macrocephala, *Clupea*, **6**

macrogaster, *Ilisha*, **114**

macrognathos, *Coilia*, **150**

macrolepis, *Clupea*, **70**

macrophthalma, *Harengula*, **76**

Platyaster, 11, **113**, 115

macrops, *Opisthopterus*, **122**

macrura, *Hilsa*, **95**

maculata, *Alausa*, 87, **88**

maculatum, *Ethmidium*, 88, **89**

maculosa, *Harengula*, **28**

maderensis, *Clupea*, **47**, 85

Sardinella, **47**, 48, **49**, 59, 61, 85

majorina, *Harengula*, **29**

Harengula pensacolatae, **30**

malabarica, *Clupea*, **8**

Thryssa, **161**, pl. 10a

malabaricus, *Engraulis*, **161**, pl. 10a

malhi, *Sardinella*, **45**

margaritifera, *Demicoilia*, **153**, 155

martii, *Pristigaster*, **103**

mediterranea, *Meletta*, **41**

Megalops bimaculata, 11, **97**

cepediana, **96**

cyprinoides, **85**

notata, **75**

oglina, **73**, 96

megaloptera, *Ilisha*, 11, 111, **113**, 116,

pl. 7c, pl. 8a

megalopterus, *Platyaster*, 111, **113**, 115, pl. 8a

megalura, *Setipinna*, **145**

melanota, *Ilisha*, **112**

melanura, *Alausa*, 37, **66**

Clupea, **62**

Sardinella, 37, 59, 61, **62**, **64**, **66**,

pl. 3c, d, pl. 4a

melastoma, *Clupea*, 11, 105, 110, **111**

Pellona, **111**

Melet, 23, **127**, pl. 9b

Meletta, **20**

lile, **72**

mediterranea, **41**

novae-hollandiae, **21**

obtusirostris, **34**

senegalensis, 85, **86**

suoerii, 11, **84**

thrissa, **73**

venenosa, **35**

venosa, **82**

vulgaris, **20**, pl. 2b

meletta, *Engraulis*, **127**, pl. 9b

Melette, 23

Menidia, **128**, 131

menidia, *Atherina*, **129**

microlepis, *Alausa*, **95**

micropus, *Clupea*, **13**

Ilisha, **115**

Pellona, **115**

mitchilli, *Anchoa*, **127**

Anchoa mitchilli, **128**

Engraulis, **127**

mordax, *Engraulis*, **132**

motius, *Clupanodon*, 12, **115**

Ilisha, 114, **115**

Pellona, **115**

mucronatus, *Gnathobolus*, **104**, pl. 7d

Odontognathus, 7, 8, 103, **104**, pl. 7d

- muelleri*, *Sprattus*, 22
Mugil salmoneus, 85
mystax, *Clupea*, 141
Thryssa, 144
mysticetus, *Cetengraulis*, 132
Myste, 141
Mystus, 124, 141, 148
altus, 75
clupeoides, 141, 148, 149
ensiformis, 148, 149, pl. 11b
ramcarati, 148, 152
mystus, *Clupea*, 12, 141, 142, 148, 149
Coilia, 12, 142, 148, 149, pl. 11b
Engraulis, 149
- nasus*, *Clupea*, 97
Nematalosa, 97
Nematalosa come, 96
nasus, 97
neohowii, *Sardinella*, 45
Neosteus, 105
ditchela, 111
nigricaudata, *Sardinella*, 66, 68
nilotica, *Alosa fallax*, 81
notacanthoides, *Clupea* (*Alosa*), 87, 88
notacanthus, *Clupea*, 88
notata, *Dorosoma*, 96
Megalops, 75
novacula, *Ilisha*, 114
Pellona, 119, 121
novae-hollandiae, *Meletta*, 21
novae-hollandiae, *Sprattus*, 21
nudus, *Chirocentrus*, 11, 115
nymphaea, *Clupea*, 40
- obtusirostris*, *Meletta*, 34
Odontognathus, 6, 103
compressus, 104
mucronatus, 7, 8, 103, 104, pl. 7d
panamensis, 104
oglina, *Megalops*, 73, 96
oglinum, *Opisthonema*, 73, 75, 96, pl. 5c
Opisthonema, 73
oglinum, 73, 75, 96, pl. 5c
thrissa, 73, 98
Opisthopterus, 100, 121
dovii, 122
effulgens, 122
macrops, 122
tardoore, 122, pl. 9a
valenciennesi, 122
- orbignyana*, *Pellona*, 105, 107
osbecki, *Chatoessus*, 98
otaitensis, *Clupea*, 11, 37, 65
ovalis, *Harengula*, 94
- Palasah*, 91
palasah, *Alausa*, 91
Clupea, 91
pallasii, *Clupea*, 16
Clupea harengus, 16
pallida, *Anchovia*, 133
panamensis, *Odontognathus*, 104
Paralosa durbanensis, 90
Peddakome, 96
Pedda poorawah, 141, 149, 150
Pellona, 105
brachysoma, 115
castelnaeana, 106, 107, 108
ditchela, 11, 105, 110, 115, 116, pl. 7b
ditchoa, 116, pl. 8b
dussumieri, 113, pl. 7c
filigera, 117
flavipinnis, 106, 107, 110, pl. 7a.
gabonica, 112
grayana, 119
hoevenii, 111
iserti, 112
leschenaulti, 118
melastoma, 111
micropus, 115
motius, 115
novacula, 119, 121
orbignyana, 105, 107
russellii, 114, 116
schlegelii, 119
vimbella, 119, 120
xanthoptera, 117
- pensacolae*, *Harengula*, 29
perfasciata, *Anchoviella*, 127
perforata, *Sardinella*, 54
petenense, *Signalosa*, 20
Petit Cailleu, 25, pl. 2c
phaeton, *Pristigaster*, 102
phasa, *Clupea*, 145
Setipinna, 145, 148
pilchardus, *Sardina*, 86
Piquitinga, 128, 131, pl. 10a
piquitinga, *Engraulis*, 131
playfairii, *Coilia*, 149
platycephalus, *Alosa*, 85
Platyaster indicus, 115, 116
macrophthalmia, 11, 113, 115

megalopecterus, 111, 113, 115, pl. 8a
verticalis, 11, 115, **116**, 123
platypterus, *Xiphias*, **102**
Pomolobus aestivalis, **83**
chrysoschloris, **84**
pseudoharengus, **83**
 Poorawah, **141**
 Poorwa, **158**, pl. 10c
Potamalosa, **22**, **87**
potiana, *Anchovia*, **133**
Pristigaster, **8**, **100**, pl. 6c
americanus, **102**
cayana, 11, **100**, 101, **102**, pl. 6c
cayanus, **8**, **100**
dolloi, **112**
flavipinnis, **106**, pl. 7a
martii, **103**
phaeton, **102**
sinensis, **119**
tardoore, 121, **122**, pl. 9a
tartoor, 121, **122**
triangularis, 11, **100**, 102
 PRISTIGASTERINAE, **99**
Pristigastre, **102**, 158
pristigastroides, *Ilisha*, **114**
Pristogaster elongata, 115, **122**
indicus, 115, **122**
productissima, *Dussumieria*, **14**
pseudoharengus, *Alosa*, **82**, **84**
Clupea, **82**
Pomolobus, **83**
 Pucelle, **77**
pumila, *Spratella*, 18, **19**, pl. 2a
punctata, *Clupea*, **31**
punctatus, *Herklotsichthys*, 31–36, 58, 62,
 94
purava, *Thryssa*, 141, **144**

quadragesimalis, *Coilia*, 149, **152**

Raonda russeliana, **123**
ramcarata, *Apterygia*, **123**
ramcarati, *Coilia*, 149, **152**
Mystus, 148, **152**
reynaldi, *Coilia*, 149, **150**
ringens, *Engraulis*, **132**
Rogenia alba, 17, pl. 1d
 Rousse, **82**
rufa, *Clupea*, **81**
russeliana, *Raonda*, **123**
russellii, *Chirocentrus*, 11, 115
Pellona, **114**, 116

sagax, *Sardinops*, **57**
salmoneus, *Mugil*, **85**
sapidissima, *Alosa*, **84**
Sardina pilchardus, **86**
 Sardine des Antilles, **27**, pl. 2d
 Sardine de la Martinique, **27**
Sardinella, **36**
albella, 53, 59, 70, 72, pl. 4c
anchovia, **42**
aurita, 11, 36, **37–43**, pl. 1b
brachysoma, **54**, 59
brasiliensis, 42, **43**
bulan, **70**
cameroniensis, **48**, **86**
clupeoides, **69**
dayi, 56, 59, **60**
eba, **48**
fimbriata, 50, 59, 60, p. 4b
gibbosa, 32, 34, 37, **51**, 58, 59
granigera, **47**, **48**
humeralis, **76**
jussieu, **61**
jussieui, 59, 94
leiogaster, 40, **68**
lineolata, **31**
longiceps, **44–46**
maderensis, **47**, **48**, **49**, 59, 61, **85**
malhi, **45**
melanura, 37, 59, 61, **62**, **64**, **66**,
 pl. 3c, d, pl. 4a
neohowii, **45**
nigricaudata, **66**, **68**
perforata, **54**
sindensis, **59**
sirm, **69**
zunasi, **59**
Sardinops sagax, **57**
schlegelii, *Pellona*, **119**
schoneveldii, *Clupea*, **20**
schrammi, *Clupea* (*Harengula*), **20**
scombrina, *Alausa*, **46**
Scutengraulis, **140**
senegalensis, *Alosa*, 11, **86**
Meletta, 85, **86**
Setipinna, **145**
megahura, **145**
phasa, **145**, 148
taty, 144, **146**, **147**
setipinna, *Clupea*, **85**
setirostris, *Clupea*, 85, **140**
Thryssa, **85**
setosa, *Clupea*, **85**, **88**

- Signalosa petenense*, 20
sima, *Clupea*, 120
sindensis, *Sardinella*, 59
sinensis, *Clupanodon*, 57, 63
Clupea, 8, 12, 57, 63, 91, pl. 6b
Pristigaster, 119
sirm, *Sardinella*, 69
sladeni, *Ilisha*, 114
spilura, *Harengula*, 105
spinifer, *Anchoa*, 129, 134
Engraulis, 129
spinifera, *Anchoviella*, 131
Spratella, 18
fibriata, 50, 61, pl. 4b
pumila, 18, 19, pl. 2a
tembang, 52
Spratelloides argyrotaenia, 136
gracilis, 136
Sprattus, 18, 20
antipodum, 22
bassensis, 22
fuegensis, 22
haleciformis, 18
muelleri, 22
novae-hollandiae, 21
sprattus, 19, 20, pl. 1d, pl. 2a, b
sprattus, *Sprattus*, 19, 20, pl. 1d, pl. 2a, b
Stolephorus, 124, 135
bataviensis, 138
buccaneeri, 139
commersonii, 7, 135, 136, 137-139,
 pl. 9c, d
indicus, 138, 139
insularis, 138
japonicus, 135
surinamensis, 133
stolifera, *Lile*, 89
striata, *Alausa*, 75
suoerii, *Meletta*, 11, 84
surinamensis, *Stolephorus*, 133

tampo, *Chattoessus*, 94
tardoore, *Opisthopterus*, 122, pl. 9a
Pristigaster, 121, 122, pl. 9a
tartoor, *Pristigaster*, 121, 122
Tartoor, 115, 122, pl. 9a
taty, *Engraulis*, 146
Setipinna, 144, 146, 147
Telara, 145
telara, *Clupea*, 145
tembang, *Spratella*, 52
tenuifilis, *Engraulis*, 147

teres, *Etrumeus*, 13
thoracata, *Escualosa*, 17, 70, 71-72
Kowala, 52, 70, 71
Thrissa, 140, 141
hamiltonii, 123, 140
thrissa, *Clupanodon*, 75, 96
Clupea, 73, 75, 96, 98, 141
Meletta, 73
Opisthonema, 73, 98
Thrisses, 141
Thrissina, 139
baelama, 140
thrissina, *Harengula*, 89
Thrissocles, 140
Thryssa, 8, 12, 140
dussumieri, 142
hamiltonii, 158, pl. 10c
malabarica, 161, pl. 10b
mystax, 144
purava, 141, 144
setirostris, 85
vitirostris, 144
thryssa, *Clupanodon*, 98
Thryssus, 140
toli, *Alausa*, 93
Hilsa, 90, 91
Hilsa (Tenuialosa), 93
triangularis, *Pristigaster*, 11, 100, 102
Trichis, 7, 12, 77
Bellonii, 77
Trichosoma, 140
tricolor, *Anchoa*, 131, pl. 10a
Engraulis, 131
triza, *Clupea*, 75
tropica, *Clupea*, 6, 16, 113, 156
tuberculosa, *Clupea*, 7, 140, pl. 9c

valenciennesi, *Opisthopterus*, 122
variegata, *Gudusia*, 96
venenosa, *Meletta*, 35
venosa, *Clupea*, 35
Meletta, 82
verticalis, *Platyaster*, 11, 116, 123
vimbella, *Pellona*, 119, 120
vitirostris, *Thryssa*, 144
vittargentea, *Clupea*, 7, 12, 136, 139
vittata, *Clupea*, 129
Clupeonia, 37, 62, 66
Harengula, 37, 62
vittatus, *Herklotsichthys*, 63
vulgaris, *Alausa*, 77, 78
Meletta, 20, pl. 2b

vulpes, Albula, 85

Wallah, **115**

White-Bait, **23**

White-Bite, **19**

Wong-tsark, **40**

xanthoptera, Ilisha, 114, 118

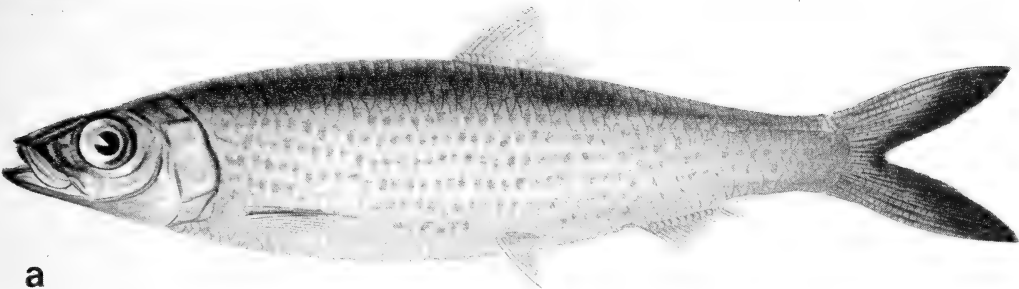
Pellona, 117

Xiphias platypterus, 102

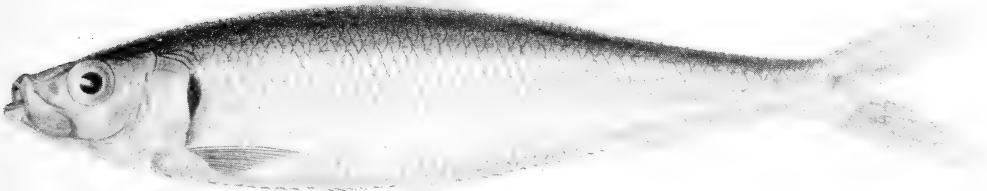
zunasi, Sardinella, 59

PLATE I

- a. *Dussumieria acuta* (= *D. acuta*), from Valenciennes (1847, pl. 606).
- b. *Sardinella aurita* (= *S. aurita*), from Valenciennes (1847, pl. 594).
- c. *Harengula latulus* (= *Harengula clupeiola*), from Valenciennes (1847, pl. 595).
- d. *Rogenia alba* (= *Sprattus sprattus*), from Valenciennes (1847, pl. 598).



a



b



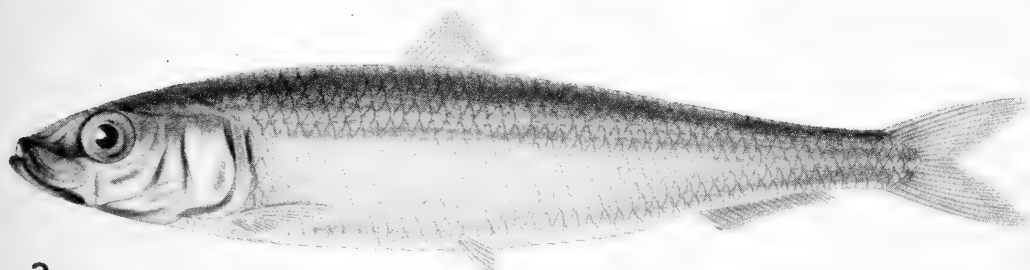
c



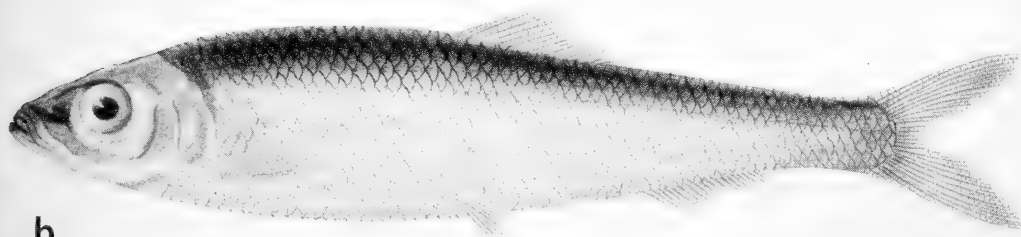
d

PLATE 2

- a. *Spratella pumila* (= *Sprattus sprattus*), from Valenciennes (1847, pl. 600).
- b. *Meletta vulgaris* (= *Sprattus sprattus*), from Valenciennes (1847, pl. 603).
- c. "Petit Cailleu" of Duhamel (1776, pl. 31, fig. 2) (= *Harengula clupeiola*).
- d. "Sardine des Antilles" of Duhamel (1776, pl. 31, fig. 4) (= *Harengula humeralis*).

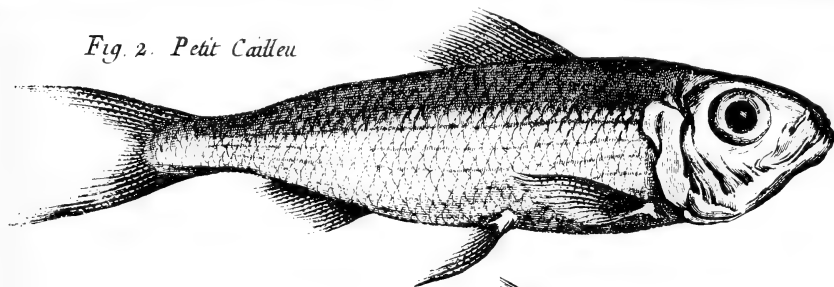


a



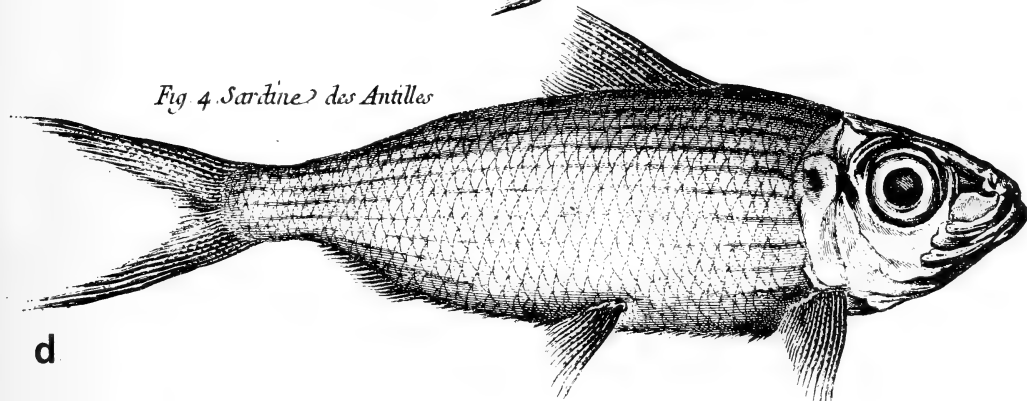
b

Fig. 2. Petit Cailleu



c

Fig 4 Sardine des Antilles



d

PLATE 3

- a. "La grande Sardine de l'Ile de France". Commerson drawing in Bibliothèque Centrale, MNHN. (*Vélins du Muséum*, **93**, No. 73) (= *Sardinella* sp.).
- b. "Var. du Clupanodon chinois" of Lacepède (1803, pl. 11, fig. 2) (= *Sardinella* sp.) (based on Commerson drawing, above).
- c. "Clupanodon jussieu". Commerson drawing in Bibliothèque Centrale, MNHN. (*Vélins du Muséum*, **93**, No. 74) (= *Sardinella melanura*).
- d. "Var. du Clupanodon jussieu" of Lacepède (1803, pl. 11, fig. 3) (= *Sardinella melanura*) (based on Commerson drawing, above).

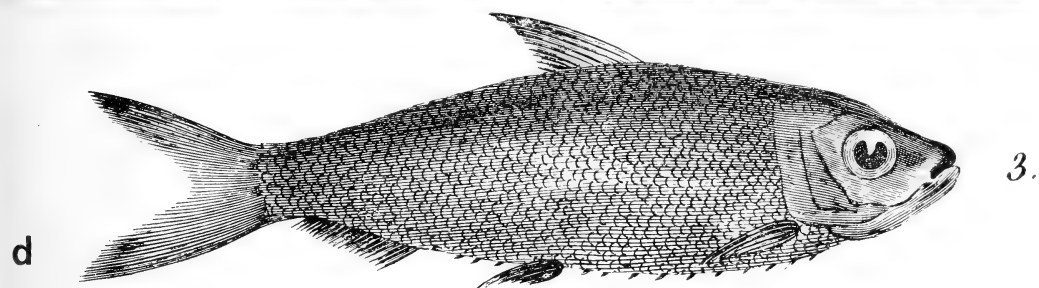
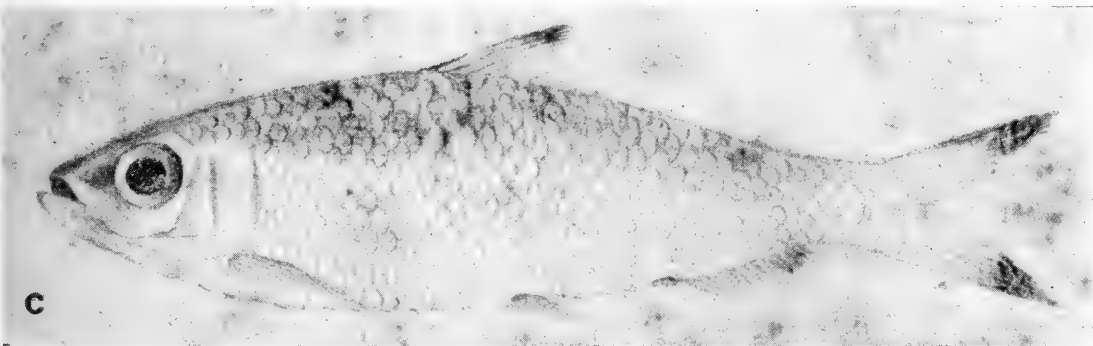
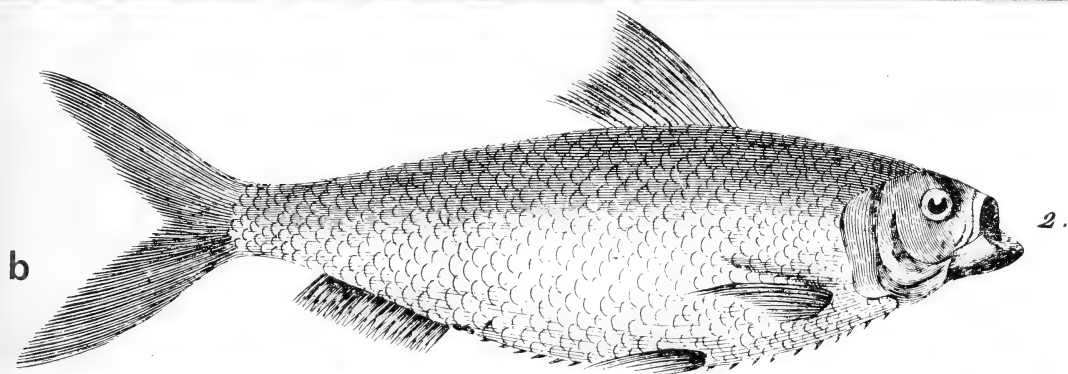
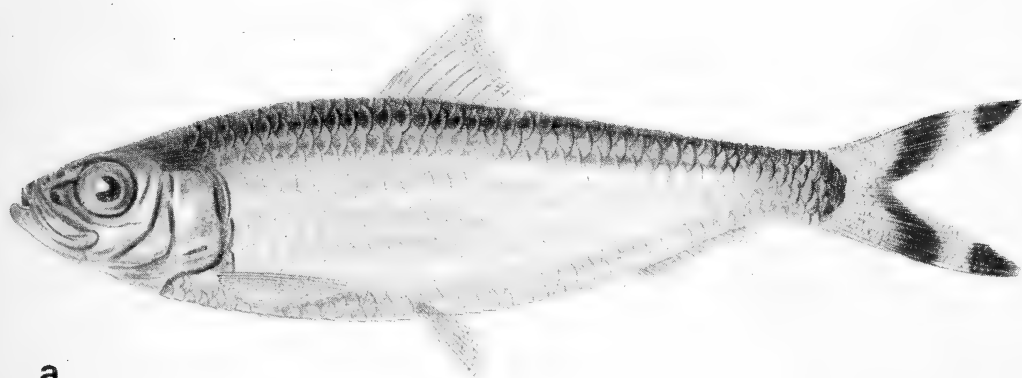


PLATE 4

- a. *Clupeonia jussieui* (= *Sardinella melanura*), from Valenciennes (1847, pl. 599).
- b. *Spratella fimbriata* (= *Sardinella fimbriata*), from Valenciennes (1847, pl. 601).
- c. *Kowala albella* (= *Sardinella albella*), from Valenciennes (1847, pl. 602).



a



b



c

PLATE 5

- a. "Kowal" of Russell (1803, pl. 186), basis for *Clupea coval* Cuvier (*nomen dubium*).
- b. *Clupea fimbriata* (= *Ethmalosa fimbriata*), from Bowdich (1825, fig. 44).
- c. "Halex festucosus". Plumier drawing in Bibliothèque Centrale, MNHN. (MS. 24, pl. 4) (= *Opisthonema oglinum*).

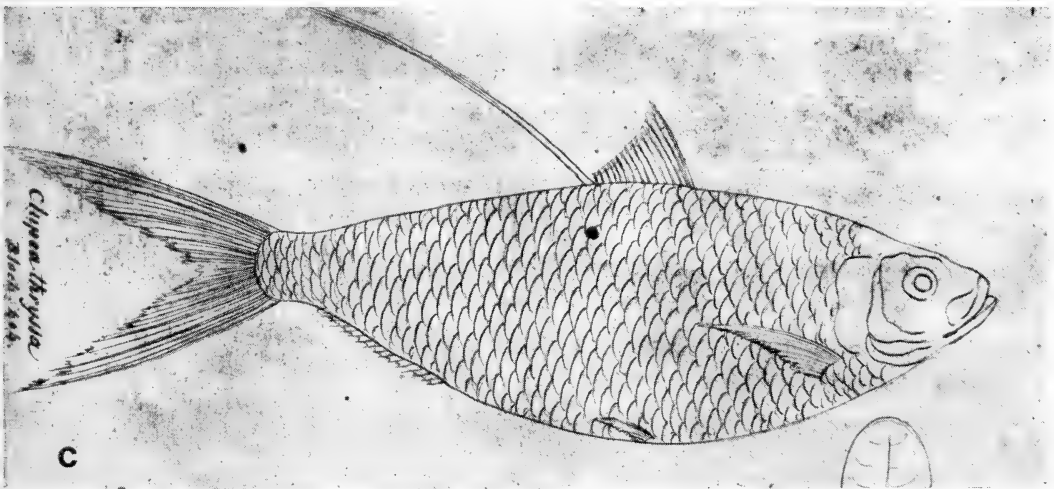
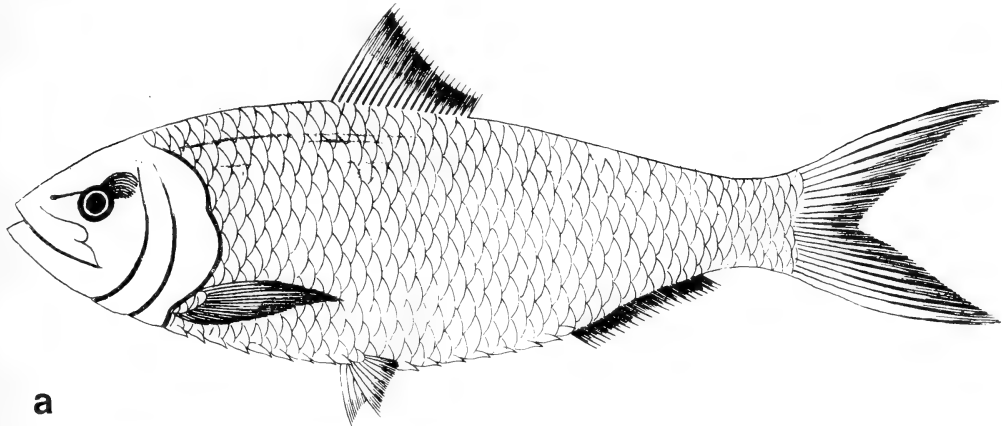


PLATE 6

- a. "Keelee" of Russell (1803, pl. 195), basis for *Clupea kelee* Cuvier (= *Hilsa kelee*).
- b. *Clupea sinensis* (= *Hilsa kelee*), from Bloch (1795, fig. 405).
- c. *Pristigaster* of Cuvier (1817, pl. 10, fig. 3) (= *Pristigaster cayana*).

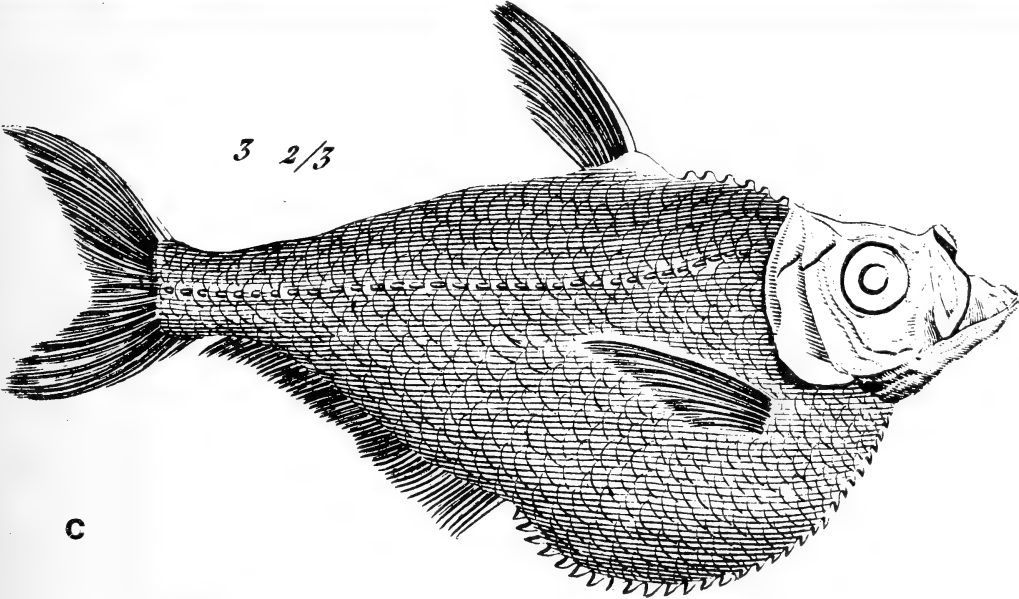
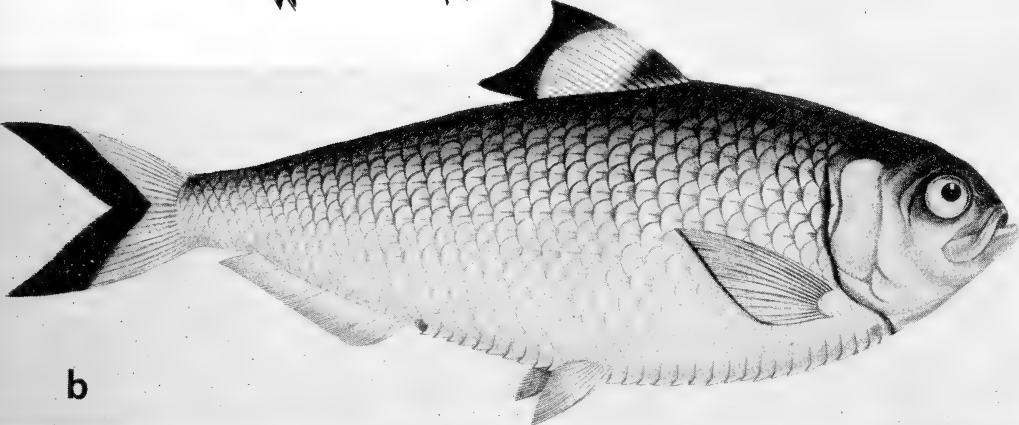
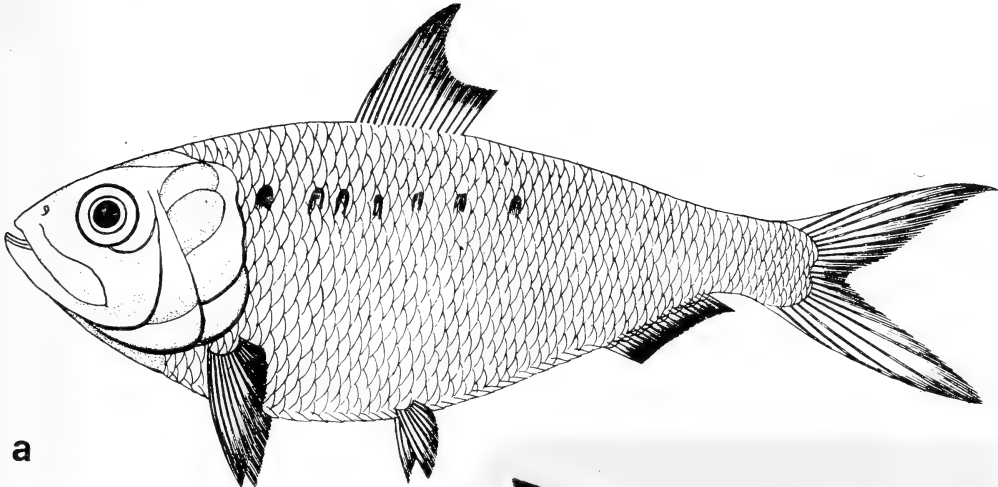


PLATE 7

- a. *Pristigaster flavipinnis* (= *Pellona flavipinnis*), from Valenciennes (1837, pl. 10, fig. 2).
- b. "Ditchelee" of Russell (1803, pl. 188), basis for *Pellona ditchela* Valenciennes (= *Pellona ditchela*).
- c. *Pellona dussumieri* (= *Ilisha megaloptera*), from Valenciennes (1847, pl. 596).
- d. *Gnathobolus mucronatus* (= *Odontognathus mucronatus*), from Valenciennes (1847, fig. 611).

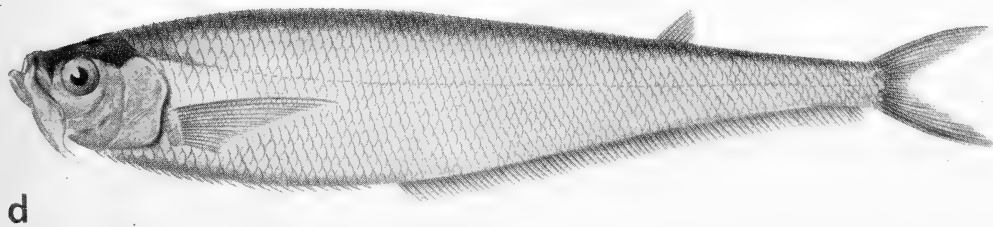
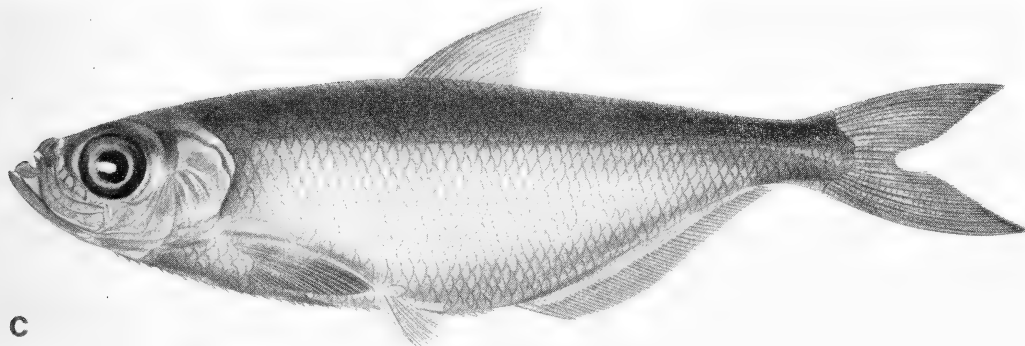
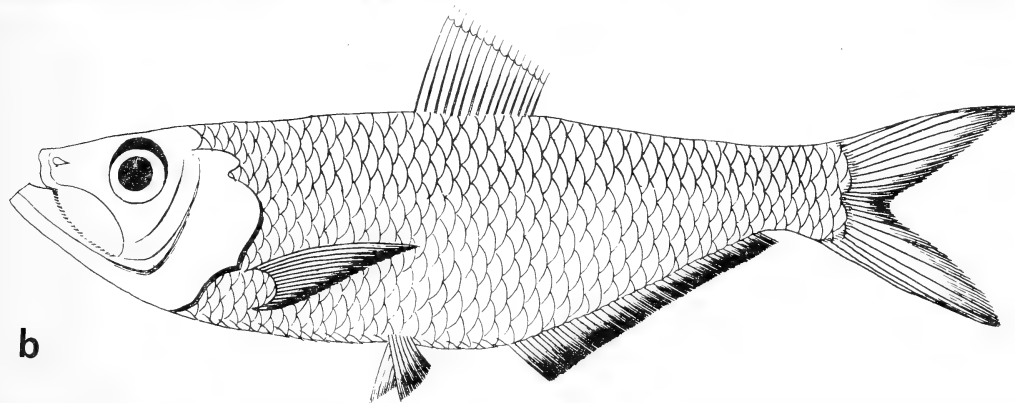
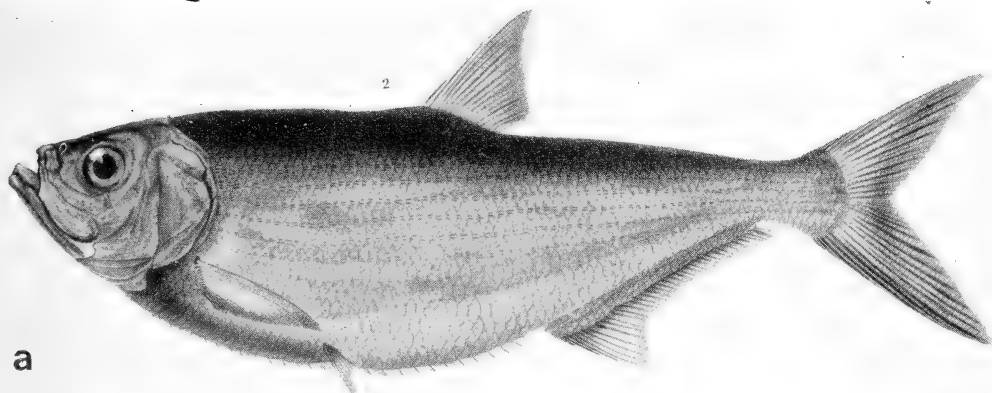
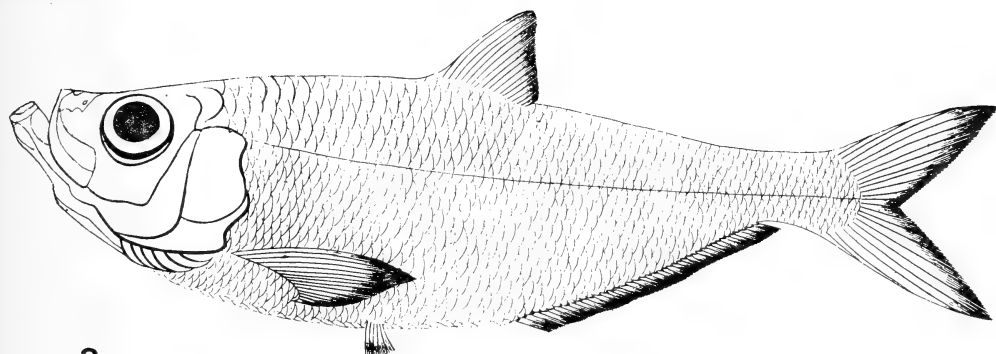
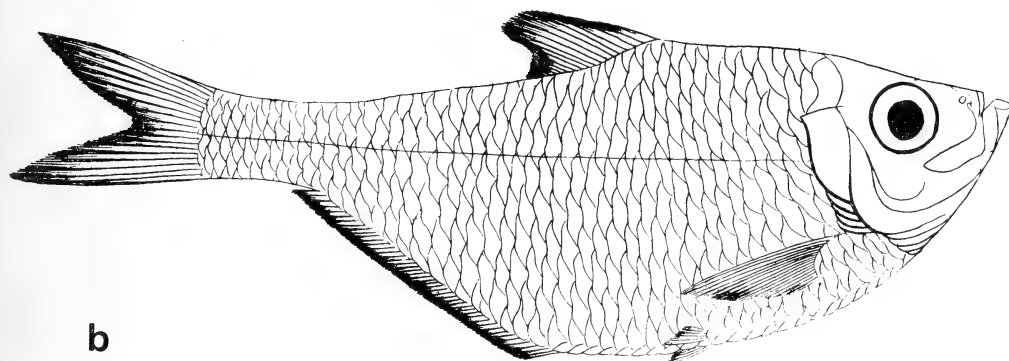


PLATE 8

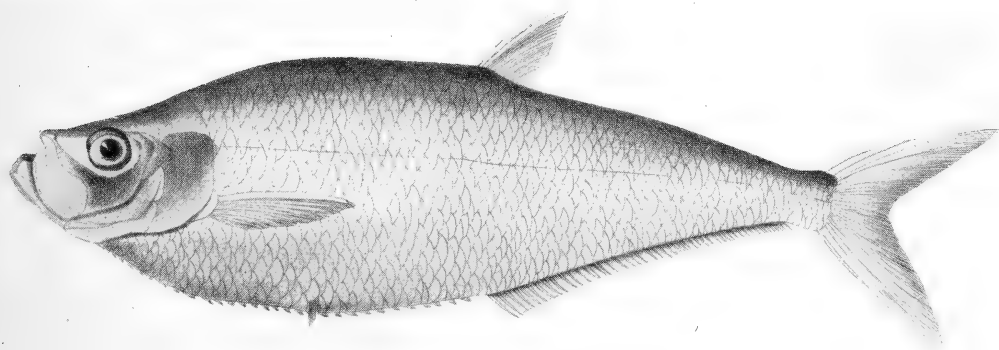
- a. "Jangarloo" of Russell (1803, pl. 191), basis for *Platygaster megalopterus* Swainson (= *Ilisha megaloptera*).
- b. "Ditchoee" of Russell (1803, pl. 192), basis for *Pellona ditchoa* Valenciennes (= *Ilisha indica*).
- c. *Clupea affinis* (= *Ilisha elongata*), from Gray (1830, pl. 96, fig. 2).



a



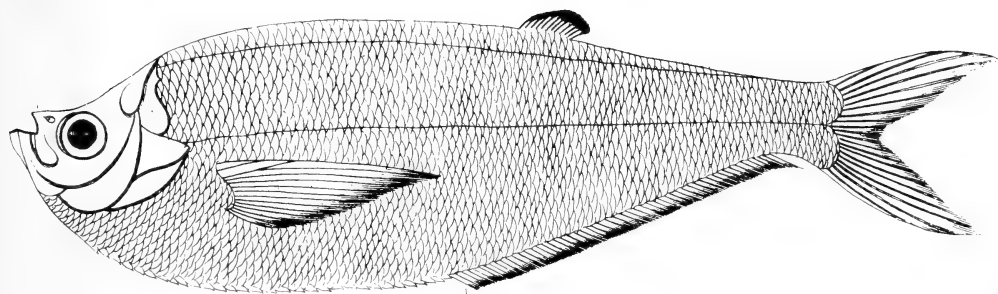
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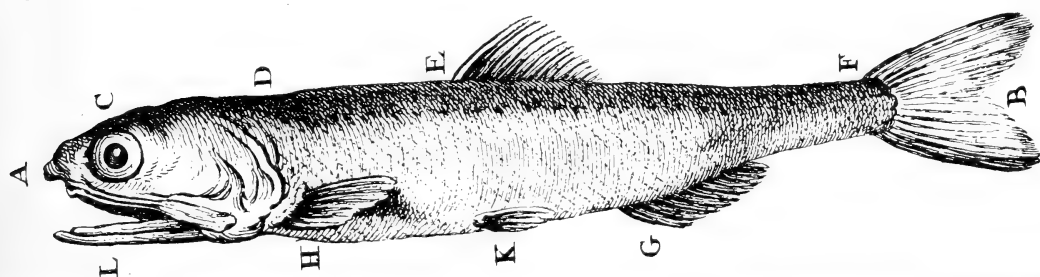
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PLATE 9

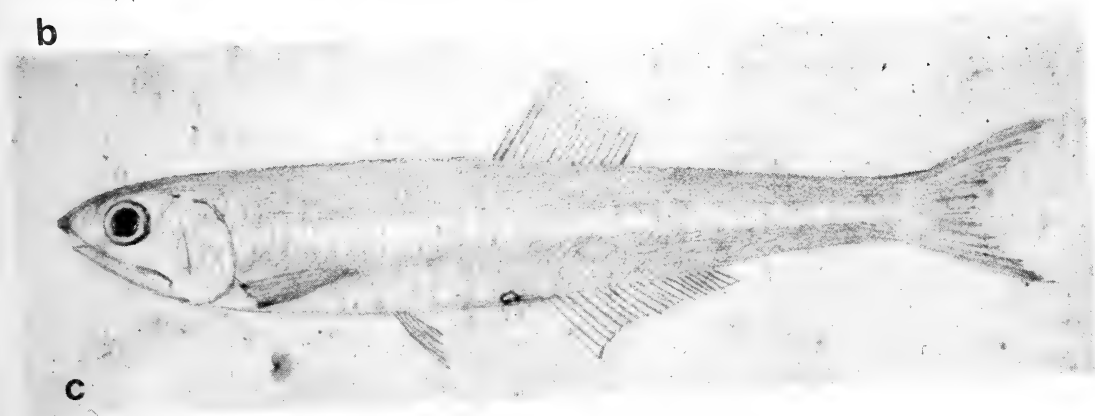
- a. "Tartooré" of Russell (1803, pl. 193), basis for *Pristigaster tardoore* Cuvier (= *Opisthopterus tardoore*).
- b. "Le melet" of Duhamel (1777, pl. 3, fig. 5), basis for *Engraulis meletta* Cuvier (= *E. encrasicolus*).
- c. "Enchrasicolus—*Clupea tuberculosa*". Jossigny drawing amongst Commerson papers in Bibliothèque Centrale, MNHN. (*Vélins du Muséum*, **93**, No. 74 bis) (= *Stolephorus commersonii*) (basis for Lacepède's figure, below).
- d. *Stolephorus commersonii* (= *S. commersonii*), from Lacepède (1803, pl. 12, fig. 1).



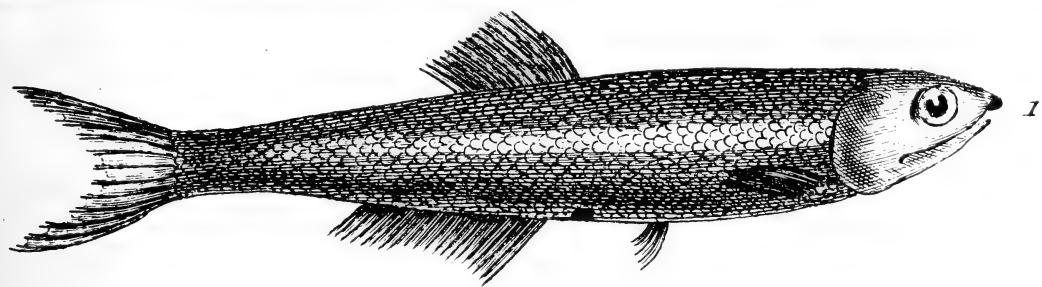
a



b



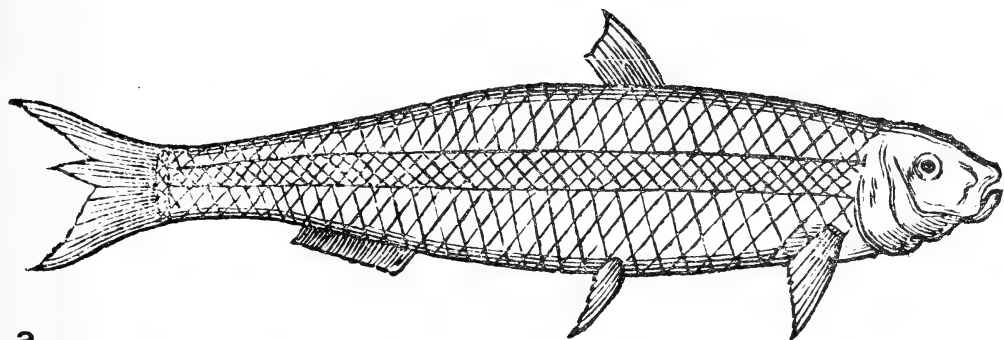
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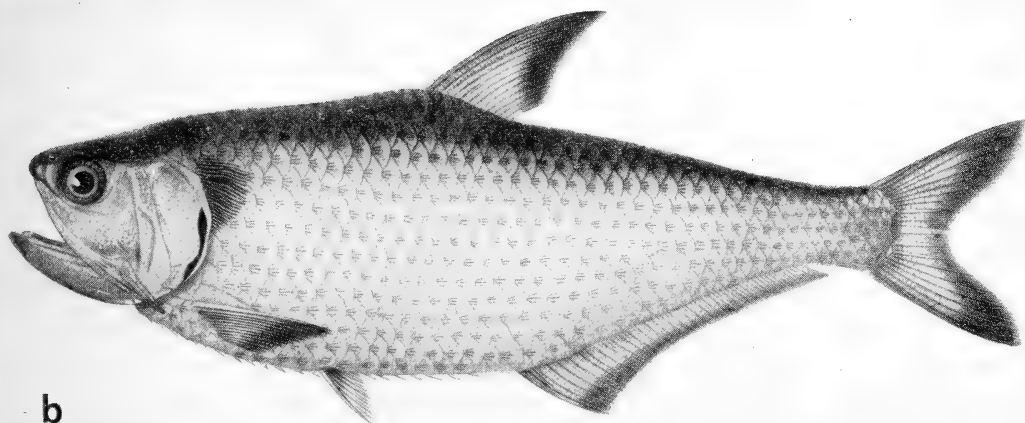
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PLATE 10

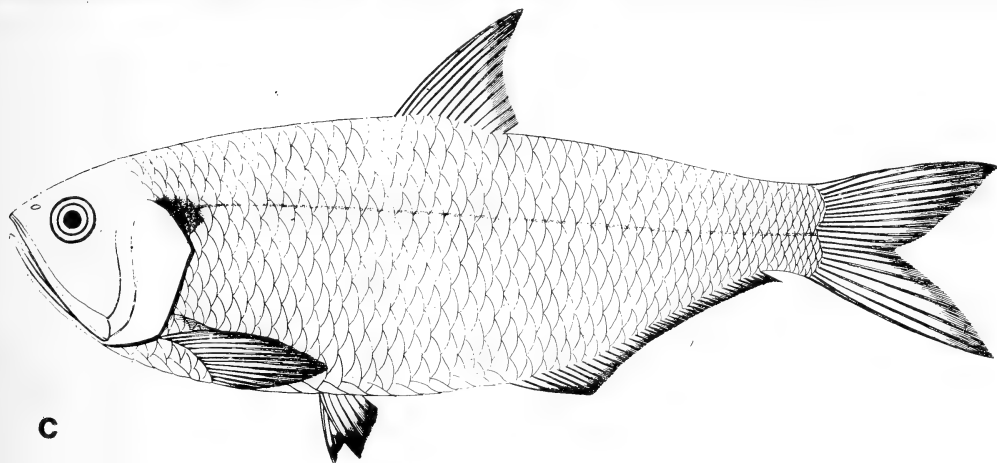
- a. "Piquitinga" of Marcgrav (1648, p. 159), basis for *Engraulis lemniscatus* Cuvier (= *Anchoa tricolor*).
- b. *Engraulis malabaricus* (= *Thryssa malabarica*), from Valenciennes (1847, pl. 609).
- c. "Poorwa" of Russell (1803, pl. 194) (either *Thryssa malabarica* or *T. hamiltonii*).



a



b



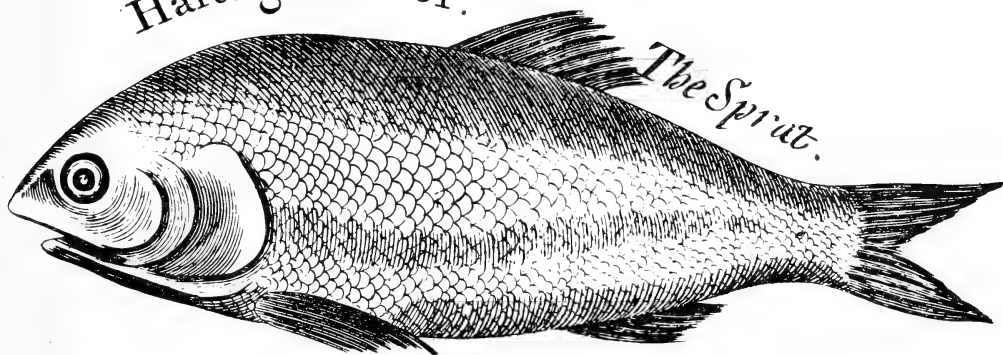
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PLATE II

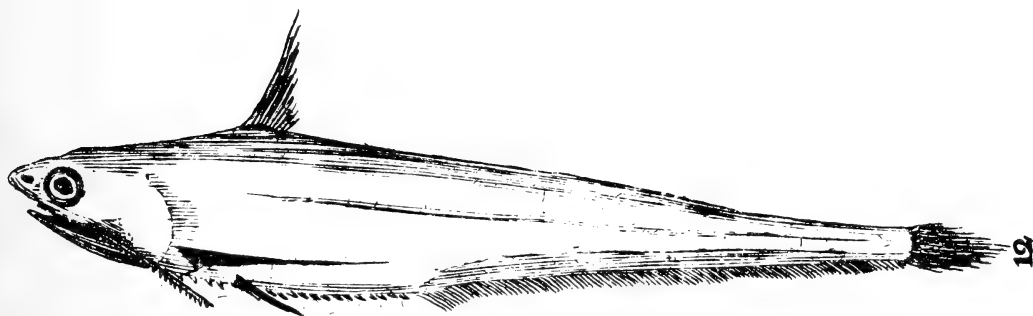
- a. "Harengus minor" (= *Cetengraulis edentulus*), from Sloane (1725, pl. 250, fig. 2).
- b. *Mystus ensiformis* (= *Coilia mystus*), from Linnaeus (1754, fig. 12).
- c. *Coilia dussumieri* (= *C. dussumieri*), from Valenciennes (1847, pl. 610).

Fig. 2.
Harengus minor.

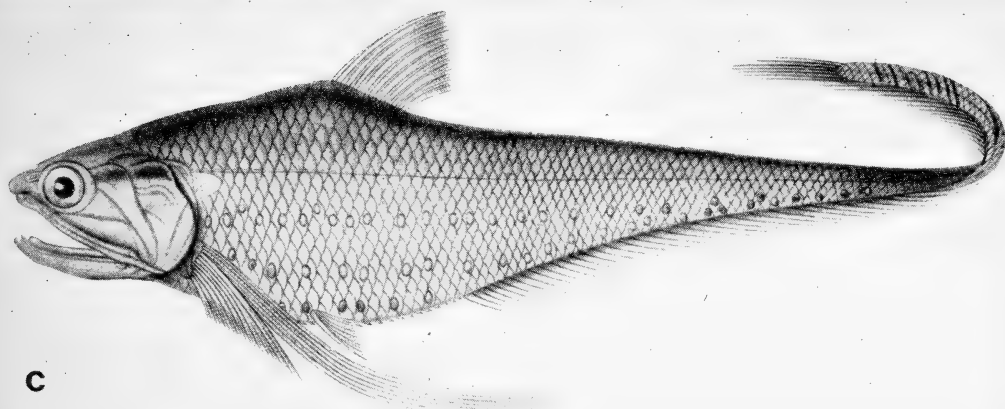
The Sprat.



a



b



c



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